electrical contracting

Industrial Electrification SECTION

PAGES 129-140

Special Features in this Issue

Charts of the Code Changes...

To make it easy for you to pick out, and remember the new rules — how the 1940 Code revision affects each job.

Case Studies in Good Lighting

Showing recent progress in both incandescent and fluorescent lighting in both commercial and industrial buildings.

OCTOBER • 1940

BETTER PROTECTION . . . FASTER PRODUCTION . . .

USE PLANNED G-E FLOODLIGHTING

Even though emergency production calls for more industrial floodlighting quickly . . . whether complete new installations or additions—there is no need to resort to makeshift protection. Haphazard installation of lights around a plant will not economically illuminate buildings and industrial yards for nighttime protection. Instead, efficient, lowest-cost floodlighting calls for the planned utilization of each unit to provide light where it is needed to prevent trespassing and malicious destruction. G-E lighting engineers have acquired a specialized experience in designing and recommending the right floodlighting facilities to safeguard production, personnel, and property.

NEW LOW-COST SEARCHLIGHT

General Electric equipment—a complete line of spun- and cast-aluminum, copper-bronze, and porcelain-enamel units for every floodlighting need—now includes a low-cost 18-inch incandescent searchlight. The concentrated beam can be projected in any direction and used to supplement the yard or fence lighting where there is the slightest suspicion of trouble.

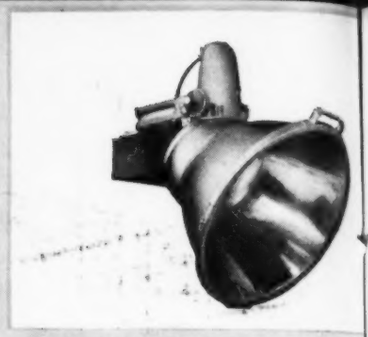
To the contractor who wants his customer to have maximum protection and effectiveness from his next installation: Let your nearest G-E distributor or G-E office supply all the equipment you need—floodlights, cable, time switches, transformers—our extensive distribution service assures prompt delivery. General Electric, Schenectady, N. Y.

WE OFFER YOU COMPLETE LIGHTING RECOMMENDATIONS

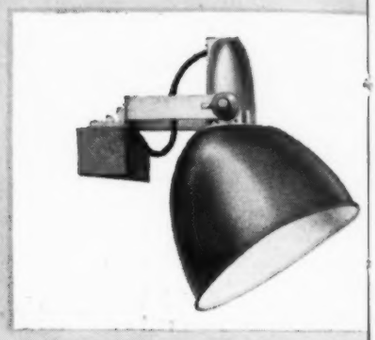
Your inquiry for suggestions or a complete lighting recommendation will be given immediate attention by a trained lighting specialist in our nearest office. If necessary it will be sent to our Illuminating Engineering Laboratory in Schenectady. This will save you time and money and assure a successful floodlighting job. Write today; there is no cost or obligation.

GENERAL ELECTRIC

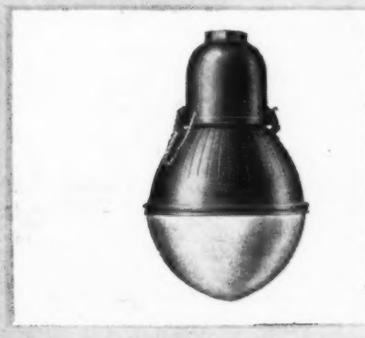
451-22



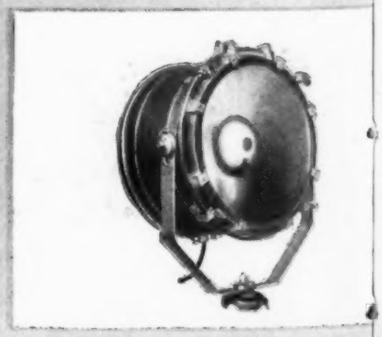
G-E low-priced, spun-aluminum floodlight a high efficiency that compares favorably the most expensive copper-bronze or aluminum floodlights. Several beam angle 28 to 100 degrees and a variety of mo attachments make these floodlights suitab almost all applications.



Inexpensive porcelain-enamel, 300- to 150 floodlights produce a wide-angle flood o used principally for lighting medium- and sized ground areas. Auxiliary inside refl are used for greater range. One-piece, di aluminum socket housing with rubber cable bushing.



The Form 79 luminaire is admirably suite lighting fence or property lines because light-distribution pattern. Deflectors withi globe, or glass refractors, redirect a large p of the light along and within the fence line stepped reflector makes possible the use of watt multiple lamps.



The Type S-5, 1000/1500-watt, 18-inch i descent searchlight has a parabolic reflect polished Alzak-finished aluminum or sil glass. A spherical auxiliary reflector in front lamp eliminates stray light and builds u beam intensity. Simplified construction mak price low—less than half that of earlier s lights.

Quick as a WINK
Simple as ABC!

"Hang em an' forget 'em," say contractors far and wide. More profit—no headache—in this quickest, easiest of any installation.

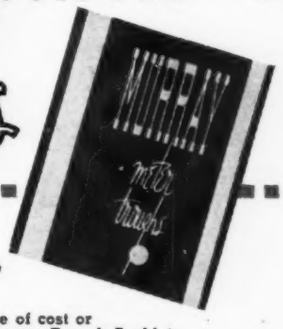
•

Troughs to suit every socket-type meter installation—indoor and outdoor. Units may be added at will—quickly—to provide for any desired length, without fitting or special work.

Metropolitan Device Corporation
1250 Atlantic Avenue, Brooklyn, N. Y.

Murray

INDOOR *meter troughs* OUTDOOR



METROPOLITAN
DEVICE CORP.
1250 Atlantic Avenue
Brooklyn, N. Y.

Please send me free of cost or obligation 20-page Murray Trough Booklet.

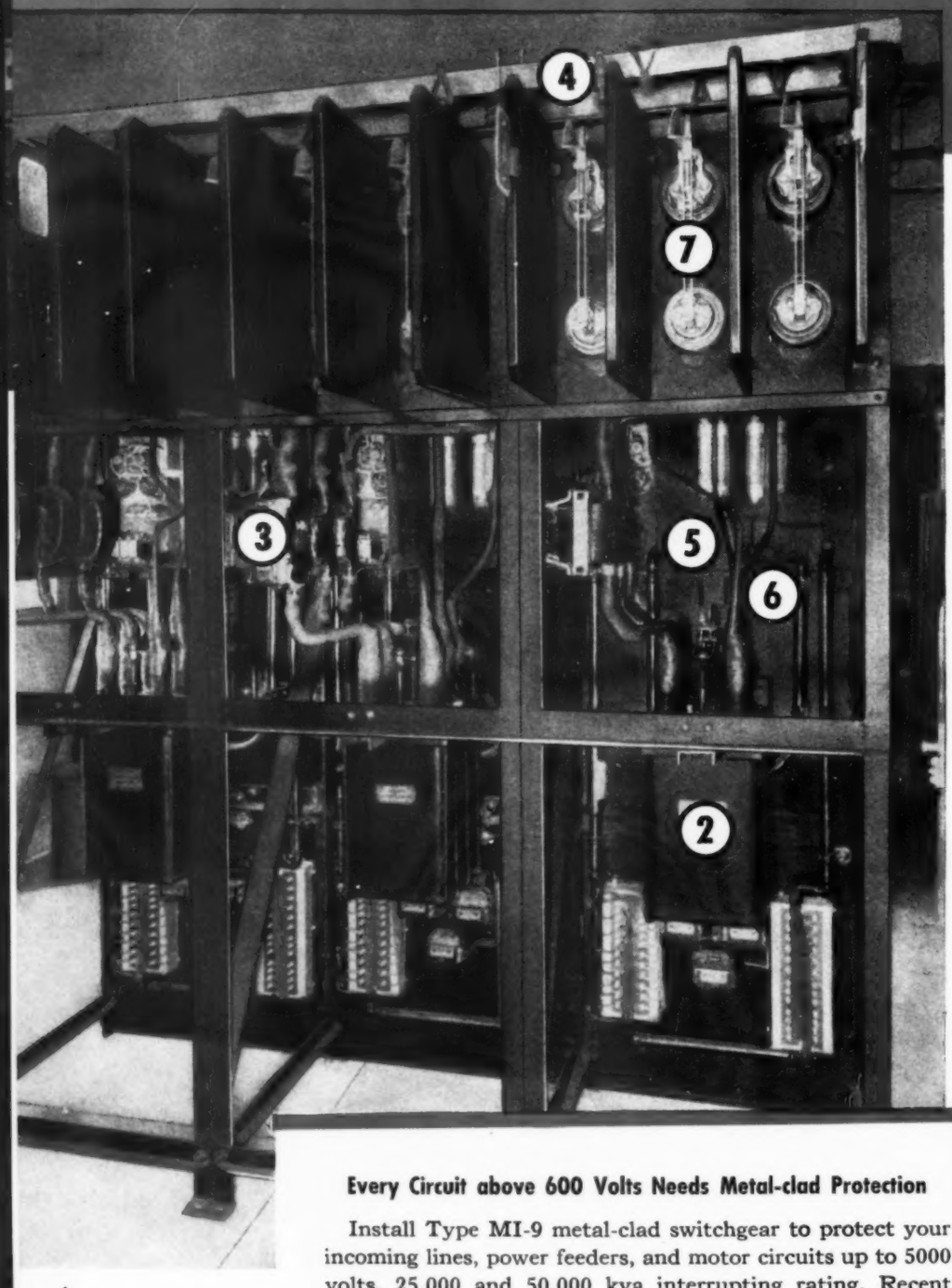
Name_____

Company_____

Address_____

COMPARE THESE

OLD OPEN TYPE

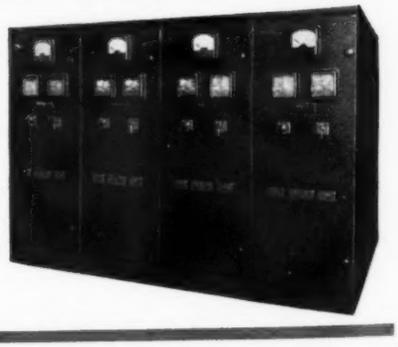


▲ Rear view of typical old open-type framework construction with exposed buses, connections, and disconnecting switches. This type of equipment presents constant hazards to service and personnel.

1. **DANGER** — Live parts are exposed
2. **DIFFICULT MAINTENANCE** — Because the breakers are stationary mounted
3. **LACK OF CO-ORDINATION** — Current transformers are often selected only on the basis of continuous current and not thermal and mechanical characteristics
4. **BARE BUSES** — Exposed to accidental contact
5. **NO ISOLATION OF ELEMENTS** — All parts of the circuit are in one large open framework
6. **CONTROL WIRING NOT SHIELDED** — Ordinary wire in compartment with primary circuit
7. **NO INTERLOCKS** — Nothing to prevent interrupting the circuit under load with disconnects
8. **DISCONNECTING SWITCHES** — Open type—hook-stick operated
9. **INSTALLATION** — Piecemeal assembly means an unpredictable amount of time and trouble

Every Circuit above 600 Volts Needs Metal-clad Protection

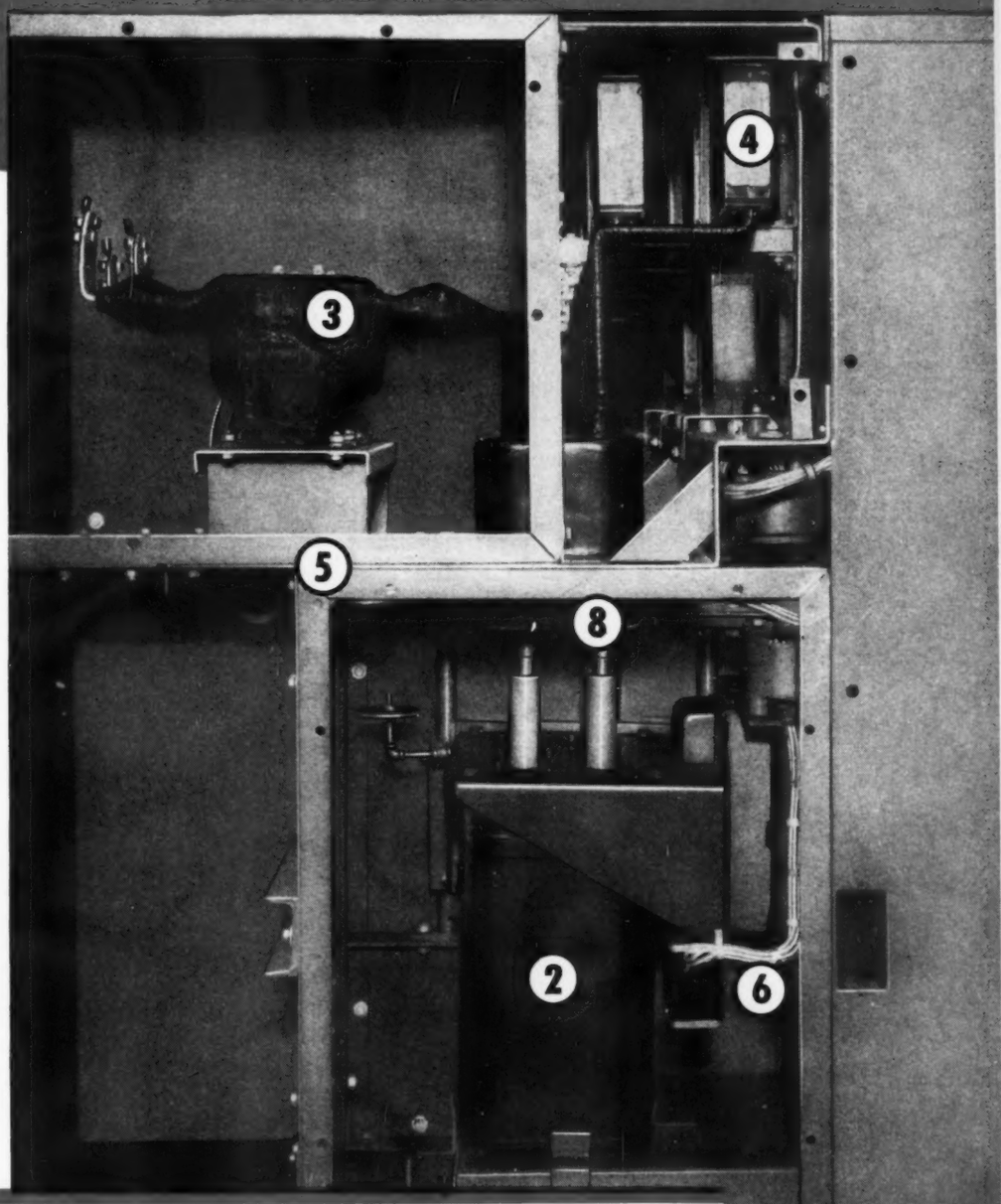
Install Type MI-9 metal-clad switchgear to protect your incoming lines, power feeders, and motor circuits up to 5000 volts, 25,000 and 50,000 kva interrupting rating. Recent price reductions make available to every industrial plant and public building the economy, safety, and convenience obtainable only with G-E vertical-lift metal-clad.



NOW YOU CAN PLAY SAFE AT LOW COST

SWITCHGEAR EQUIPMENTS

MODERN G-E METAL-CLAD



1. **SAFETY** — All live parts are enclosed
2. **EASY AND QUICK MAINTENANCE** — Because the breakers are easily removable
3. **CO-ORDINATION** — Current transformers have sufficient mechanical and thermal capacity to match circuit breaker
4. **INSULATED BUSES** — Herkolite insulation—rigid supports
5. **COMPLETE ISOLATION** — All parts of the circuit are isolated in individual steel compartments
6. **CONTROL WIRING SHIELDED** — Wiring is covered with steel protective armor
7. **MECHANICAL INTERLOCKS** — Direct acting so that the disconnecting devices cannot make or break load current
8. **DISCONNECTING DEVICES** — Lowering the breaker automatically opens the disconnects
9. **INSTALLATION** — Factory-assembled equipment is easily installed at a low, predictable cost

Ask for Our New Descriptive Bulletin

After you have compared modern G-E metal-clad with the old open-type equipment, we are sure you will want to know more about it. A switchgear specialist in the G-E office nearest you will be glad to give you the facts about this completely factory-built, shipped-assembled equipment. Ask him for a copy of our new descriptive bulletin, GEA-2249C. General Electric, Schenectady, N. Y.

▲ Side view of Type MI-9 metal-clad equipment with breaker completely disconnected and lowered on transfer truck. Side plate removed to show internal arrangement. Note method of enclosing all live parts.

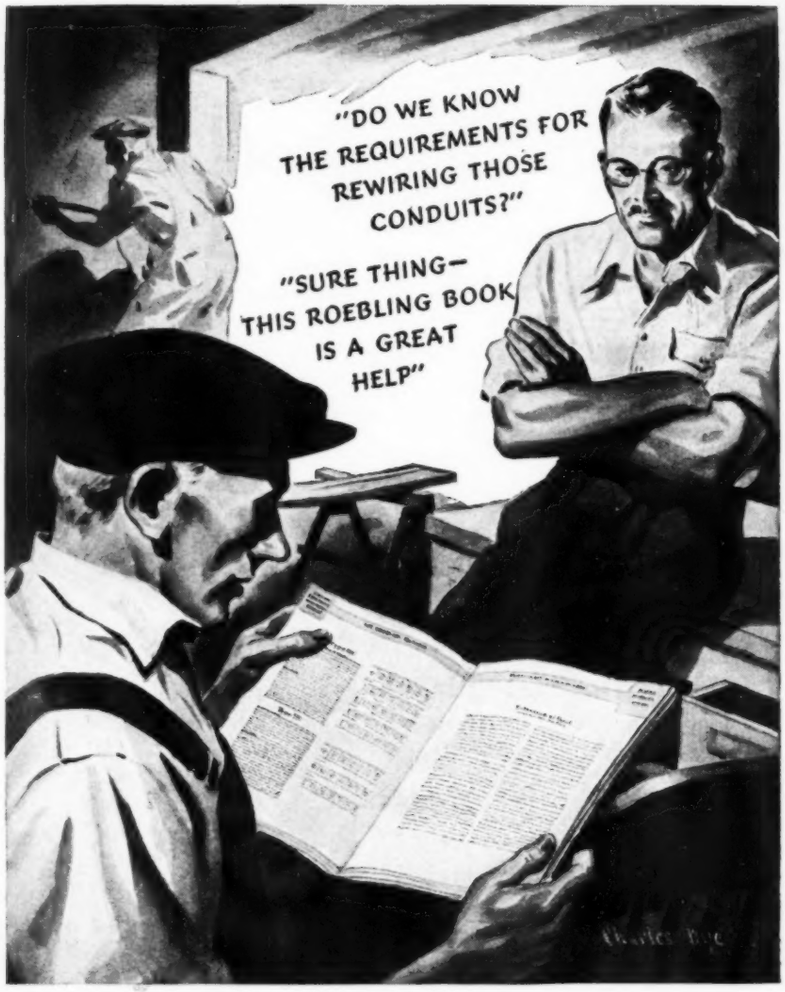
GENERAL ELECTRIC

K54-4

HERE IT IS!

The How, When, and Where of SMALL DIAMETER (THIN-WALL INSULATION) BUILDING WIRE

Roebling Catalog gives helpful data for quickly selecting *Insulation—Wire Sizes—Current Capacities—Number of Conductors*—valuable aids in the solution of specific installation problems.



SEND FOR FREE COPY

Right now, when building and plant circuit capacity must be expanded... when current loads must be stepped-up in existing conduits...Small Diameter Building Wire is the answer to your problem.

But, you ask—what are the Code Regulations? How many conductors can we use in each conduit? What insulation is most suitable for our need? These questions, and many more, *must* be answered before work can proceed.

And *Here's* the book to help you!

Just off the press—this Roebling Catalog compiles for you up-to-the-minute data. Wire Sizes... Current Capacities...Problems and Answers... these are the vital subjects covered in this catalog of Building Wire, No. 101.

Why not write for your copy today? No obligation.

Roebling Small Diameter Building Wire is made in

FOUR TYPES OF INSULATION:—

RHT—*Rubber Covered*... RPT—*Rubber Covered*
RU—*Latex Covered*... SN—*Synthetic Covered*

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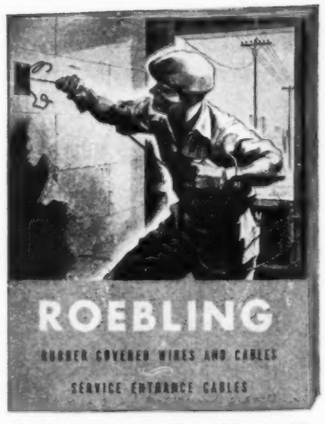
Trenton, N.J. Branches in Principal Cities



Ask for Catalog No. 101

ROEBLING SMALL DIAMETER BUILDING WIRE

electrical contracting

With which is consolidated The Electragist and Electrical Record
Established 1901

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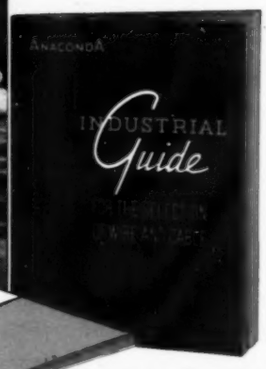
YOU'LL BE MORE SUCCESSFUL
With a Good Rod and Reel

Don't let the big ones get away from you!

NO question about it—you *can* get along on the orders that just naturally come your way. But why *"handline"* business when you can use a good rod and reel? Why not use those two helpful, business-producing aids Anaconda prepared especially for you—the "Industrial Wiring Survey" and the "Industrial Wiring Guide"?

They're two of the ablest little business builders in the electrical field today. Judge for yourself. According to authorities, nine out of ten industrial plants in the country today need new wiring. Old, worn-out circuits, overloading and failure to provide proper wiring for additional equipment are causing power losses and courting electrical breakdowns. Most important of all, the majority of plant supervisors are unaware of these conditions.

The "Industrial Wiring Survey" and the "Industrial Wiring Guide" enable you to tell 'em—and sell 'em—with facts, cold, hard facts about wiring conditions that most plant operators are grateful to know.



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electrical contracting

OCTOBER, 1940

Romance—Goin' Wrong!

ABOUT THIRTY YEARS AGO what was perhaps the most dramatic chapter in the story of electricity was written. It was written in terms of light. It was when the old Holophane Company sent out a crew of picked young men to lecture on the new art of illumination.

THEY FILLED THE OPERA HOUSES, these young men, demonstrating prismatic glass and steel reflectors. They talked about eyesight, comfort, health, industrial efficiency, better merchandising. It was a new romance of science and coast to coast the people crowded in. I know. I was there. I had a finger in the advertising end of it.

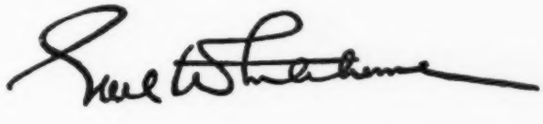
NOW, LIGHT HAS A BASIC HUMAN APPEAL. You have seen it. And that's why the fluorescent tube today has won such rapid popularity. And so we have another opportunity, we electrical men, to write another romance into the electrical story. But what are we doing?

BECAUSE OF THIS URGENT POPULARITY, we are becoming confused and confounded. Everybody with a sheet metal shop is getting into the tube reflector business. Manufacturers hand their lines to unqualified non-electrical jobbers to distribute. Door to door specialty men are loose in the land. And we are on the way to lose a lot of friends.

FOR THE FLUORESCENT UNIT IS NOT A FRONT DOOR PRODUCT. It is still lighting. To substitute these tubes for incandescent lamps involves the redesigning of the lighting system, new wiring, the Code, inspection. In every case it calls for the services of an electrical contractor in his dual function of consultant and installer. If we ignore this we are false to the public.

IT IS TRUE THAT ELECTRICAL MEN HAVE BEEN SLOW STARTING. Power companies feared loss of load. Wholesalers did not understand this new do-hickey. Contractors failed to realize that the whole lighting art was being revised. The market jumped at the idea and didn't want to wait. And the inexperienced manufacturer cried—"All we need is salesmen!"

IT IS NOT SO. For lighting is not a thing to sell and run. It is a service. But don't worry. These troubles are early growing pains. And if we keep our heads, this new fluorescent tube with its coolness, color, charm and beauty will make us many fortunes. But we will strangle our boom a-borning, if we permit anyone to forget that it is still lighting.



Build Up Your Wiring Business
EASY AS A-B-C

A
ELECTRUNITE STEELTUBES
This modern raceway opens the way to lower bids without lowering profits. Assembled without threading with water-tight compression fittings, STEELTUBES may be accurately bent to fit around columns, beams and other piping. Recommended particularly for use in concrete in new building construction. Newest feature is "inch-marking" on each length for quickly cutting to size. Write for Bulletin C-938 giving all the facts.
B
SMALL DIAMETER BUILDING WIRE
Here's the wire you've been waiting for to sell those jobs where more wattage is required, but where the cost factor bars replacing present raceways. The small diameter of this wire permits an increase in effective copper of as much as 400 per cent by replacing present Type R wires. GRAYBAR offers all types ...RHT...RPT...RU...SN...write for information on the possibilities of each under the new Code.
C
RIGID STEEL CONDUIT
Galvanized rigid steel conduit is the impregnable wiring raceway... strongly resistant to corrosion or physical damage. GRAYBAR has complete, convenient stocks of all standard grades and sizes; also a full line of equally sturdy condulets and fittings. Your GRAYBAR Man can suggest ways of assuring extra protection against water, corrosive fumes, tampering, etc., to protect vital industrial circuits. Call or write for information.
GraybaR
QUALITY
SINCE 1869
Everything Electrical
GraybaR
ELECTRIC COMPANY
GraybaR—IN 83 CITIES
Executive Offices:
GRAYBAR BUILDING, NEW YORK

Increasing demands for industrial speed-up mean increased demands on power and lighting circuits in both old and new buildings. Now, as never before, your industrial customers and prospects are in a mood to assure themselves of extra capacity and extra safety by fully adequate wiring. But it's up to you to show them the way.

Whether the situation calls for a modernization job using existing raceways, a major plant rearrangement calling for new conduit, or wiring an entirely new plant, you'll find GRAYBAR ready with the products you need, backed up by the satisfaction-insurance of the GRAYBAR tag. Call or write GRAYBAR for information or buying assistance on any wiring product or wiring problem.

SWITCHBOARD REBUILT *for 440-volt circuits in office building rewiring.*

FUSE BLOCKS *replaced with 440-volt fuse clip spacing.*

2 Ways TO BOOST CAPACITY

Re-wiring for increased commercial light and power loads is challenging the electrical contractor's skill and ingenuity. Here's how some of the experts do it.

FIFTEEN years ago the doors of a huge office building on Chicago's lakefront were opened to the public. That building had the most modern lighting and "adequate" wiring, with spare capacities for normal load increase. Yet in recent months about $40,000 has been spent to boost the wiring system to approximately double its original capacity.

Another building, older but also modern in its facilities, is providing greatly increased wiring capacity for better lighting in its offices. A third building is expanding branch circuit capacity, floor by floor, in a comprehensive electrical modernization program.

In almost every instance of wiring modernization in recent years there has been some reluctance on the part of owners to admit that rewiring is necessary. Some have felt that they were undersold on the original wiring job—that rewiring after only a relatively few years of the normal life of the building represents incompetent engineering—that rewiring marks the building as commercially obsolete.

The need for rewiring, however, has been created by no "normal" growth, but by an unpredictable and phenomenal increase in public demand for more light, air conditioning, water cooling and like developments. Even as recently as fifteen years ago, few men could foresee today's load demand and engineers would hardly have been justified in predicting them.

In recent years engineers and contractors have devoted a lot of effort toward devising ways and means for renewing the electrical life of otherwise modern buildings without extensive cutting and patching. Manufacturers have helped with transformers that are suitable for installation without special vault structures, small diameter wires to increase the capacity of old conduit systems, and compact panels to provide more circuit capacity in old cabinets. But, each job must be custom tailored.

AIR-COOLED *transformers convert 440-feeder voltage to 230/115 volt current to the floor distribution cabinets.*

WIREWAY DISTRIBUTES *new feeders on the third floor ceiling to four riser points.*

FEEDER RISER *trough runs in back of old gas meter closets. New panel is mounted in front.*

1. By Doubling Voltage

In Chicago's American Furniture Mart, a 16-story building with a 30-story tower, housing offices and display headquarters for wholesale furniture concerns, the McArthur Electric Company used a voltage doubling system to increase the wattage capacity of the existing feeders.

A new 440-volt alternating current single phase service was installed feeding four 4,000 amp. circuit breakers. The old switchboard was rebuilt to provide 440-volt spacing on fuse clips.

Distribution panelboards were located in closets on each floor of the building. New compact distribution panels and 440/230/115-volt insulating, air cooled transformers were installed. The original feeders were extended to the transformer primaries through a disconnecting switch. The transformer secondaries were connected through a wiring gutter to the distribution panel, from which sub-feeders were run to the new branch panelboards in existing cabinets.

The installation required 43-75 kva. and 3-50 kva. transformers. In general, single transformers are located on each of two risers at each floor. At some heavier load centers, however, two transformers are installed in one distribution closet. A separate system ground connects all of the transformer secondaries, terminating at the original system ground in the basement.

2. New Distribution in Troughs

Another excellent example of rewiring technique is the new feeder system installed in the Peoples Gas Building in Chicago. The existing direct current system was about 30 years old and rewiring for additional capacity included a changeover to the central 208/120 volt network alternating current system, without interrupting service to the building offices.

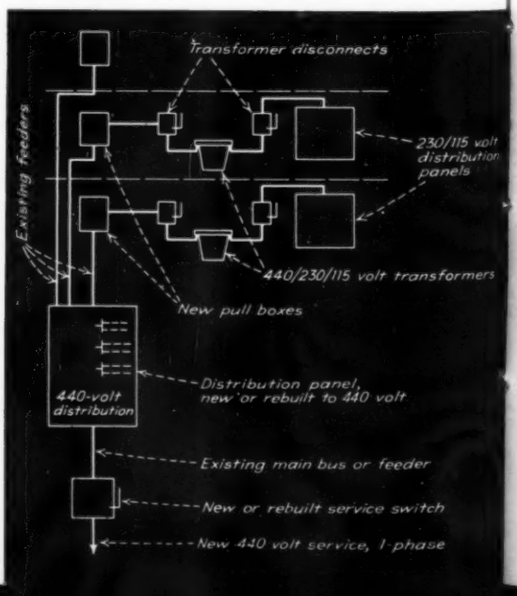
Garden City Engineering Co. of Chicago were the electrical contractors on this job. The work involved a new transformer vault, main service, distribution switchboard, feeder system and branch circuit panelboards.

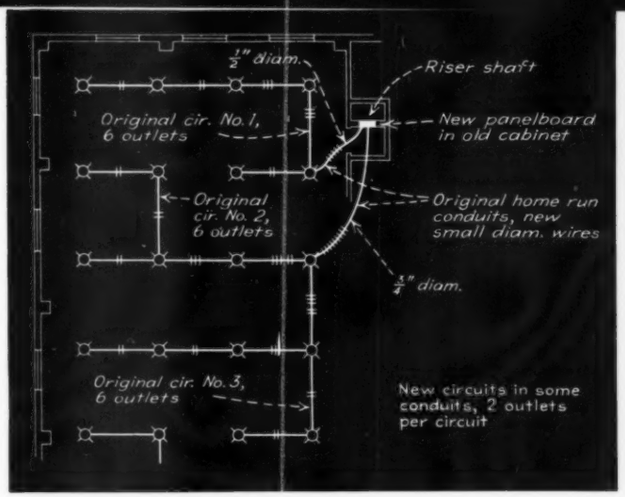
A unique system of feeder distribution in sheet metal wireways was designed to distribute the feeders through the building with a minimum of general alteration work. The existing direct current system remained in service undisturbed until the work was complete.

The metal troughs start at the secondary service entrance. Two parallel sets of tubular bus bar consisting of three 4-in. and one $1\frac{1}{2}$-in. tubes extend from the service entrance to the main switchboard. They are enclosed in a sheet metal trough with ebony asbestos supports approximately every two feet.

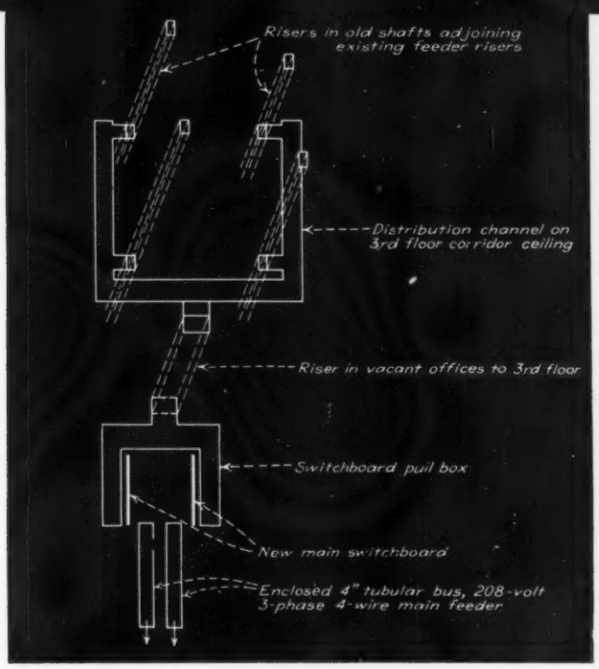
The new switchboard was built in two sections, each with 24-400 ampere switch and fuse circuits, set back to back with a U-shaped pull box above. Feeder circuits extend from the switchboard pull box into a large vertical wireway separated into individual channels. The riser wireway extends to the third floor through sale space which was remodeled to enclose the riser. At the third floor a wireway extends out to the ceiling of the third floor corridor, distributing down the center of the corridor ceiling to four riser points at the four interior corners.

TYPICAL *line diagram of converted 230-volt feeder system on 440-volts.*




½" diam.
Riser shaft
Original cir. No. 1, 6 outlets
New panelboard in old cabinet
Original cir. No. 2, 6 outlets
Original home run conduits, new small diam. wires
½" diam.
Original cir. No. 3, 6 outlets
New circuits in some conduits, 2 outlets per circuit

PART OF LIGHTING LAYOUT *showing small diameter wires in original conduit system to relieve home run bottleneck.*


Risers in old shafts adjoining existing feeder risers
Distribution channel on 3rd floor corridor ceiling
Riser in vacant offices to 3rd floor
Switchboard pull box
New main switchboard
Enclosed 4" tubular bus, 208-volt 3-phase 4-wire main feeder

SIMPLIFIED DIAGRAM *of wiring channel system enclosing new feeders.*

In this building, old gas metering closets adjoin the electric panelboard closets. The new riser troughs were installed at the back of the old gas closets and new panels installed on the face of the trough. As the riser feeders were energized, circuits were removed from the adjoining d.c. panelboards and cut over to the new alternating current panelboards. At the completion of the job the old panelboards were removed and the bottom part rebuilt into a junction box to provide a connection for the branch circuit conduits.

3. Heavier Home Runs

In both of these instances, the bottleneck of the electrical system was in the service and feeders, but in another building the electrical contractor was faced with the problem of increasing the capacity of the home runs. Lighting was increased from 200-watt units to 500-watt units on the original outlets. Home run conduits were originally installed for six outlets per circuit. The problem was to provide additional home run capacity to allow two outlets per circuit.

This job was a natural for small diameter wire. New panelboards were installed in the existing cabinets. The old home run circuits were withdrawn. The original two No. 14's to each circuit were replaced with 3 wire No. 12 small diameter wire branch circuits, up to nine wires in ¾ conduit, 5 wire in ½ conduit.

This work was handled without seriously interrupting normal routine in the building and required no other trades on the job. The increased capacity was installed floor by floor as the budget allowed.

4. Common Experience

Whether the rewiring work involves only a single floor or an entire building wiring system the job requires a careful preliminary survey and layout. Here are some of the problems encountered with some suggested methods for solving them.

Service entrances—On almost every job the service entrance may be relocated and a new line installed more easily than increasing the capacity at the original lines.

Main switch or breaker—New equipment is usually located at the new entrance and energized before the original service is disconnected. Where the old location is used for the new work a row of six smaller (and more easily obtained) switches may be used to temporarily replace large breakers or switches during the changeover.

Main switchboard—Existing switchboards may often be replaced with new as economically as rebuilding old equipment. If increased voltage is to be used, install new switches and fuse clips. If old switches are to be reused near their rated capacity, check condition of spring washers and contact surfaces. It is a good idea to allow for fuse clip clamps on all reused fuse holders.

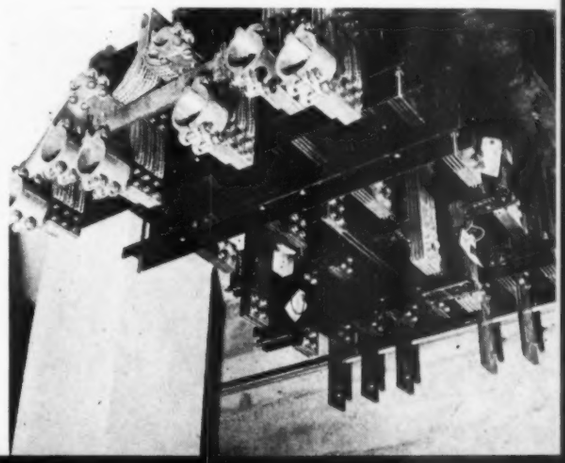
Feeders—If old d.c. systems are to be used to carry a.c. check the conduit system carefully. In old installations it was common practice to enclose large conductors in individual conduits. Clear space on one side of a column up through the building can often be built out to enclose new riser conduits economically. Check for old gas risers and gas meter closets that can be used for feeder conduits or troughs. New small diameter wires in the larger sizes may provide the needed capacity in existing conduits.

Panelboards—Many panelboard manufacturers will provide new panels to exactly fit existing cabinets at regular catalog prices. New compact designs in both fuse and circuit breaker panels with increased capacity will often fit the old cabinets. Carefully check bus bar sizes for capacity if panels are to be reused.

Home runs—If new conduit runs are required the corridor ceiling is usually the best route because it minimizes the work that must be done in the occupied offices. Surface raceways in corridor ceiling corners are out of the way and fairly inconspicuous. Small diameter wires will often fill the bill without additional conduit work.

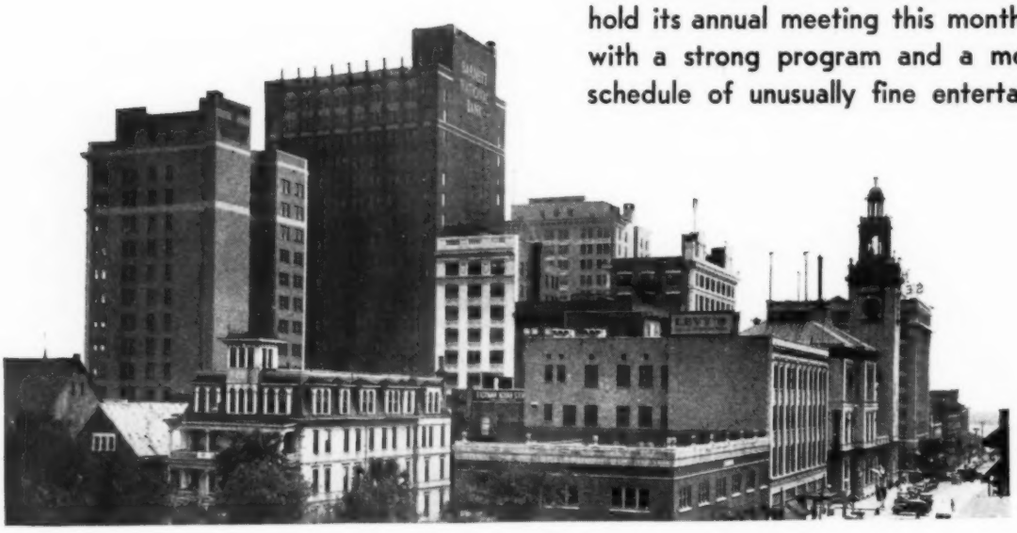
Branch circuits—If old outlets are reused, small diameter wires will usually provide the necessary additional capacity in the old conduits. Surface work with neat metal raceways are usually satisfactory for new outlets extended from the present openings.

CLOSE-UP *of 8000 ampere secondary service connection to tubular bus extending to new switchboard. Flexible connectors permit expansion and alignment of tubular bus.*



NECA to JACKSONVILLE

National Electrical Contractors Association will hold its annual meeting this month in the south with a strong program and a most appealing schedule of unusually fine entertainment.



THAT famous southern hospitality will be enjoyed in full measure by the delegates to the 38th annual convention of the National Electrical Contractors Association. For, this year, the annual round-up is being held October 20th to 23rd at Jacksonville, the "gateway to Florida".

Here in the atmosphere of one of nature's wonderlands, the electrical men will be able to review and study construction, sales, estimating, labor and management problems of their industry. And Jacksonville, being one of the largest industrial centers of Florida, presents the visiting contractor an unusual opportunity for careful study of electrical construction and installation technique under conditions different from those in his own locality.

The week will not be entirely spent in convention work for many a delegate and his family will take advantage of the six day post convention tour to Havana, which has been planned by the Jacksonville chapter of NECA as a pleasant aftermath of the business sessions.

The convention will be held in the air conditioned George Washington Hotel. The program offers a well balanced series of discussions covering market and sales development, labor relations, codes and standards, cost data and estimating and industry statistics. The product exhibit will review the latest developments in electrical apparatus and construction equipment.

Meetings begin Monday morning, October 21st with NECA President Robert McChesney occupying the chair. Morning sessions will be held Monday, Tuesday and Wednesday. Tuesday afternoon will be devoted to recreation including golf, swimming and beach parties.

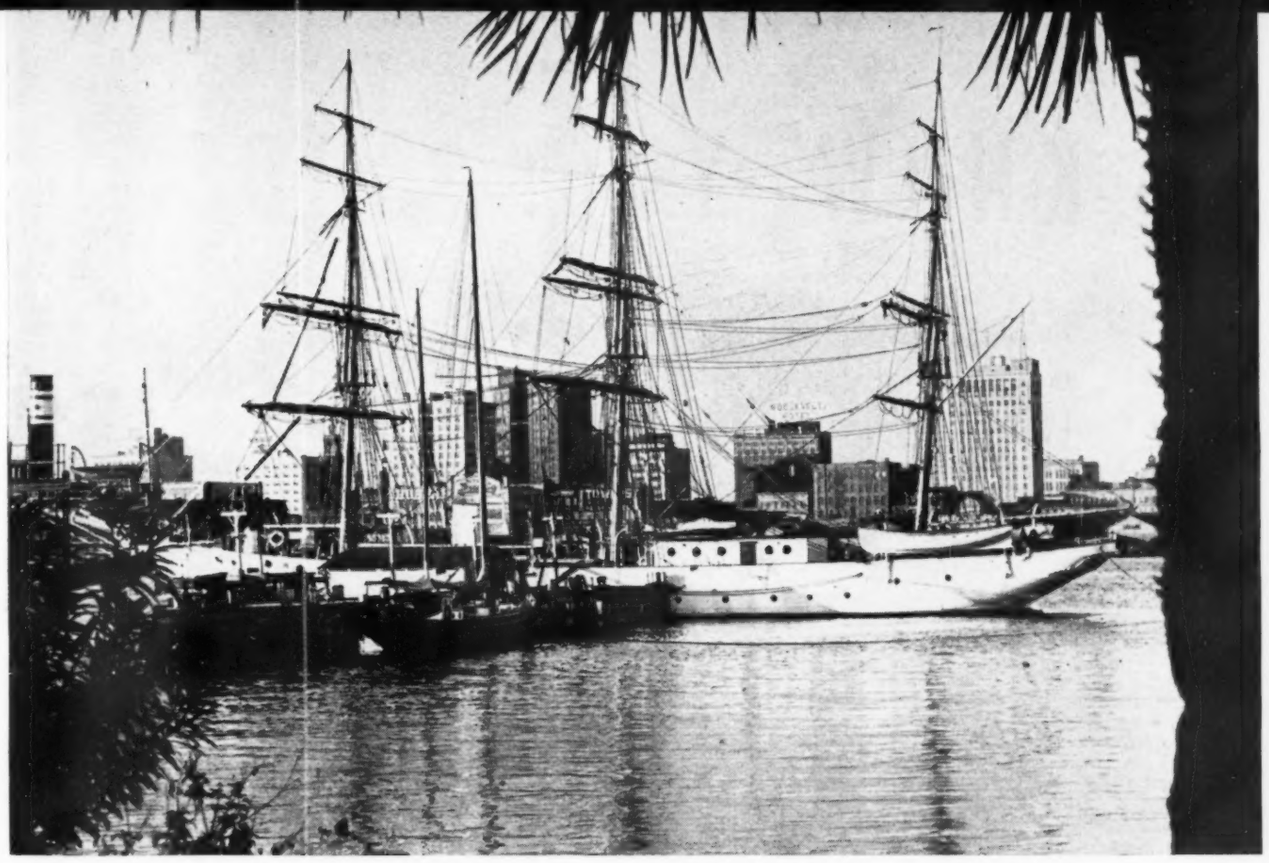
The evening schedule calls for a dinner by the IBEW Employers' Section on Monday; a beach club shore dinner and dancing Tuesday and the annual NECA banquet Wednesday on the Hotel Mayflower roof.

Thursday morning will mark the start of the post convention tour which will include four days of touring Florida and two days in Havana, Cuba.

The convention program and exhibition has been planned by the Jacksonville Chapter of NECA under the general chairmanship of W. O. Henderson, who with his committees has been laboring diligently for the past eight months to make this convention a success from both the business and pleasure standpoints. For many helpful ideas will be gleaned from the discussions and exhibit in which some 50 manufacturers will participate. And the six day holiday will provide a pleasant respite from business cares.

Of course, a lot of men look on a convention as just a junket. Well, if that's their attitude toward opportunity —OK. Though it's too bad.

SEASIDE GOLFING *amidst tropical palms and Florida sunshine, at one of Jacksonville's five challenging golf courses.*



HARBOR VIEW *of Jacksonville's skyline through the masts of a luxurious yacht anchored in the channel that connects the city and the sea*

But the Jacksonville NECA meeting this month will give back just what you really want. If you want to make whoopee, it can be done. But if in addition to a lot of fun you are after the knowledge and experience that will shine out of the papers and discussions —if you are after contact with other contractors of varying experience who can tell you things—you can get that. It's up to you.

Men who actively participate in the convention sessions get more out of it than those who only sit and listen. Men who step out and take responsibility in committee work benefit more yet. It is worth all it costs if your purpose and your attitude is right.

The travel feature this year is particularly appealing because Florida is a glamorous country, full of historical interest. St. Augustine, Jupiter Light, Miami, Lake Okeechobee are names that call strongly. Havana offers a dip into the old world that no one should miss—and to make the trip with other contractors, all friends together, enriches the opportunity immeasurably.

If you have not already made your reservations, therefore, do it today. For this convention like the last trip to the Pacific Coast will be a good time you will never forget.

NECA CONVENTION PROGRAM

SUNDAY EVENING, OCT. 20—
Reception—Buffet Supper

MONDAY MORNING, OCT. 21
Opening Convention Session

General subject: Markets & Sales Development
"President's Address"
Robert W. McChesney, Washington
"Report of the Secretary"
Laurence W. Davis, New York
"Building Salesmanship in Electrical Contracting"
D. B. Clayton, Birmingham
"The Gold Seal Building Industries' Plan of Guaranteed Electric Wiring"
Warren Penn, Burbank

MONDAY AFTERNOON, OCT. 21
IBEW Employers' Section Session

"Report of Labor Relations Committee"
E. C. Carlson, Youngstown
"Eliminating Industrial Disputes"
D. W. Tracy, Assistant Secretary of Labor, Washington
"Apprenticeship Training"
J. Walter Collins, Chicago

MONDAY EVENING, OCT. 21

Dinner sponsored by IBEW Employers' Section—Guest speaker: Edward J. Brown, International President, IBEW, Washington

TUESDAY MORNING, OCT. 22

"Meeting the Need for Increased Adequacy"
George Andrae, Milwaukee
"Calculating Conduit and Wire Sizes"
Homer G. Knoderer, Bridgeport.
"Branch Circuits and Feeders Under the 1940 Code
Joseph Whitner, Atlanta.
"Standardization and Simplification"
Dr. Morton G. Lloyd, Washington

WEDNESDAY MORNING, OCT. 23

"Taking the Gamble Out of Estimating"
George W. Patterson, Toronto
"What Have You Got to Sell?"—Analyzing the contractor's organization—Ray W. Ashley, Chicago
"Government Legislation As It Affects the Electrical Contractor"
Col. O. R. McGuire, Washington

WED. AFTERNOON, OCT. 23

"Better Knowledge of Our Industry"
A. Lincoln Bush, New York
"What the Electrical Industry of the City of Miami is doing toward Adequate Wiring"
Ellis C. Knox, Miami
Elections—Resolutions

WEDNESDAY EVENING, OCT. 23

Annual NECA Banquet
Presentation of James H. McGraw Award

KNOW Your CODE

An analysis of the changes in the 1940 National Electrical Code, as they affect wiring systems in commercial, industrial and residential buildings, discussed and charted, step by step, from service to load, as a guide to the design and installation of electrical construction.

By John M. Turnbull

Service Engineer for the United Electric Light Company, Springfield, Mass.

THE National Electrical Code has become so voluminous and complex that it is not possible for any man to judge the meaning of the 1940 revisions by a mere reading. It represents a serious job of analysis and study if the individual is to make the most of it.

And, of course, that is the approach that should be made to it. For these are not just changes. They are improvements—for progress. And they must not only be understood but applied immediately if advantage is to be taken of them and work is to be done in strict accordance with the new rulings. And the best way to accomplish this is to chart these changes and make an actual picture of their significance to the wiring job.

Therefore, last month we presented a condensed charting of the principal changes in the 1940 Code. We gave particular attention to the installation value of the new small diameter wires and a comparison of the conductor insulations that are now available and the uses for which they have been developed.

This for general background. But the contractor, the plant electrical chief and the men must see the applications and implications of these changes beyond this. It must all be clear in terms of the job. And so we support these general observations with detailed discussion of how the new revisions affect commercial, industrial and residential installations of wiring and apply to modernization work in any type of occupancy. And to simplify it, we have keyed the charts and the discussion to a marginal drawing of the typical elements of the wiring system itself. Where table numbers are given, these numbers refer to tables in the 1940 National Electrical Code.

The purpose of it all is practical, to provide a quick digest that can become a reference tool. It is intended for use by journeymen and helpers as well as bosses. Therefore, copies of these pages and those published in September issue will be available to readers of *Electrical Contracting* who may desire extra copies at a special price. If you want some, say so.

I. Code Changes Affecting Commercial Wiring

Revisions in new Code involve rules on signs and outline lighting, fixtures and receptacles, switches, outlet boxes, flexible cords, wiring methods and materials and the use of cellular-metal floor raceways. Adequacy of branch circuits and the use of small diameter wires for rewiring are probably the most important changes.

ADEQUACY of branch circuits and thin-wall insulations for rewiring are probably the most important features that will be introduced into commercial wiring by the 1940 Code. These innovations along with the revised current-carrying capacities of conductors will greatly affect commercial wiring design in 1941.

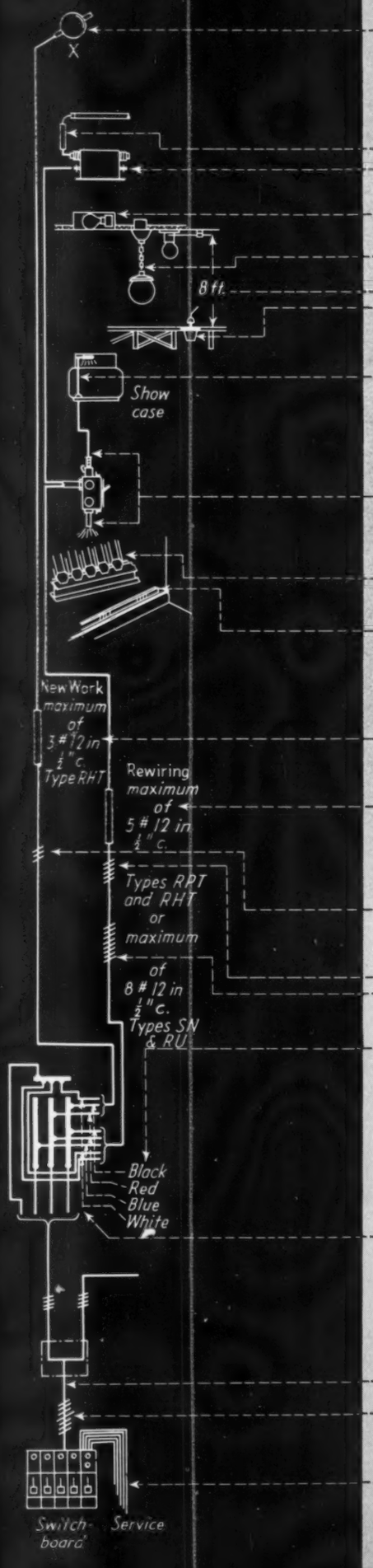
Under the 1937 rules, at least a minimum feeder capacity had to be provided in certain commercial occupancies; whereas in residences, minimum requirements not only had to be met in feeder capacity, but also in the number of branch circuits installed. What the 1940 issue will do will be to extend into commercial work the principle of requiring at least a certain minimum of branch circuits on a watts-per-square-foot basis.

Wattage requirements for general lighting can well be divided into four groups. First, we have offices, schools and stores for which the 1937 wattage requirements for feeders remain unchanged but these values are now also to be used in computing branch circuits. Feeder demand factors may be applied to offices and schools but not to stores.

In the second group are dwellings, hospitals and hotels where feeder values have all been stepped up to 2 watts-per-square-foot, and wherein this value applies to branches. However, revised demand factors will result in about the same feeder requirements.

COMMERCIAL WIRING — 1940

CHART ILLUSTRATING SOME OF THE PRINCIPAL CHANGES IN THE 1940 NAT. ELEC. CODE


X
8 ft.
Show case
New Work maximum of 3 # 12 in ½" c. Type RHT
Rewiring maximum of 5 # 12 in ½" c.
Types RPT and RHT or maximum of 8 # 12 in ½" c. Types SN & RU
Black
Red
Blue
White
Switch-board
Service

	CODE SECTION
X-RAY—ART. 660	
Scope of rules to include X-ray machines used for any purpose; medical fruit examination, etc.	6601
SIGNS & OUTLINE LIGHTING—ART. 600	
New rules on High-Voltage Inside Lighting will govern transformer type, cable, tube terminals, etc.	6011-15
Transformers in Residences not to exceed 60 milliamperes.	6011
Over 5000 volts, no single run of cable in metal raceway to exceed 20 ft.	6031
Transformers may have terminals at grounded midpoint.	6031
FIXTURES, RECEPTACLES—ART. 410	
Flush and Recessed fixture installations will be regulated by completely new rules on wiring, etc.	4123
Fixtures having Mogul lampholders must be wired with type AF fixture wire.	4139
Cleat-type lampholders, receptacles and rosettes having live exposed parts to be at least 8 feet above the floor.	4104
With any floor plug, an approved floor box must be used.	4173
FLEXIBLE CORDS—ART. 400	
New type AFS (rubber-jacketed heat-resistant) added to type S for use in show windows and show cases.	4005
SWITCHES—ART. 380	
Switches in "Damp or Wet Locations" (see new definitions) to be of externally operable type enclosed in metal boxes or cabinets.	3803
OUTLET BOXES, ETC.—ART.370	
Number of conductors in a box definitely limited by revised rule. Stud, clamp or hickey reduces number by one. Switch or receptacle, two less.	3705
Boxes of non-conducting material recommended with non-metallic sheathed cable where moisture is likely to be present.	3720
CELLULAR METAL FLOOR RACEWAYS—ART. 356	
Entirely new article.	
SURFACE METAL RACEWAY—ART. 352	
May be used up to 300 volts, and over if metal not less than 0.04 in. thick.	3522
OK now up to No. 6 A.W.G. (formerly No. 8) 30-ampere fusing limitation removed.	3523
WIRING METHODS & MATERIALS—ART. 300	
Small Diameter Building wire type RHT may be used generally in place of types R, RP, or RH. RHT available in sizes 14, 12, 10 and 8.	3005d
Except for rewiring, standard conduit fill table applies to RHT.	
For rewiring in Existing Raceways for increased load where it is impracticable to increase the size of raceway, types RPT, RHT, RU and SN available.	3005e
Special conduit fill tables apply. 50% fill to be permitted for 3 or more conductors on such rewiring.	Table II
Current-Carrying Capacities dependent upon number of conductors in raceway or cable.	3006a
1-3 conductors — 100% rated capacity.	
Note: Neutral conductor carrying only unbalanced current not to be counted in determining capacity, therefore capacity of 4-wire 3-phase circuit is 100%.	
4-6 conductors — 80% rated capacity.	
7-9 conductors — 70% rated capacity.	
BRANCH CIRCUITS—ART. 210	
Multi-wire branches to be color-coded and all conductors of same color to be connected to same feeder conductor.	2104
Watts-per-square-foot rules for general lighting loads and for determination of minimum number of branch circuits now extended to many commercial occupancies. See separate tabulation.	2107 2108
Other occupancies will be figured like in 1937, viz., rating of appliance, 5 amperes for heavy-duty lampholder and 1½ amperes for other outlets.	
Show window requirements of 200 watts per foot now to be included in branch circuit calculations.	2108
PANELBOARDS—ART. 384	
Panelboards having switches on load side of fuses not to be installed, except as service equipment.	3885
GARAGES—ART. 510	
In commercial garages (see new definition) conduit, tubing, surface raceway, armored cable, wireway, busway or cellular floor to be employed.	5102
FEEDERS—ART. 220	
For rewiring of large feeders (see 3005e above) type SN synthetic insulation available up to No. 4/o.	
Common Neutral feeder — when in metal all feeder conductors to be within same enclosure.	2205
SERVICES—ART. 230	
Busway may be used as service conductors not exceeding 600 volts.	2331

Thirdly, five additional occupancies are listed in 1940 namely armories and auditoriums, banks, churches, clubs and restaurants. A wattage value has been assigned to each of these for both the computation of feeder capacities and branch circuits. No feeder demands are applicable here.

In the fourth group are lofts, garages and storage warehouses for which the 1937 values remain unchanged, but note that in such buildings no branch circuit minimum requirements are called for.

It should also be noted that an 80 per cent limitation applies to branches supplying continuous loads, as in store lighting, so that the number of branches in such cases must exceed by at least 25 per cent the values called for by Code wattage.

Perhaps the most publicized innovation in the 1940 issue is the combination of the use of thin-wall insulations, plus increased allowable conduit fill when rewiring. In offices, stores, and other buildings where it is impracticable to increase the size of the raceways, and where we want to rewire for increased loads, the smaller wires (up to No. 10 for Types RU and RPT, No. 8 for RHT) will serve branch circuit needs, and the new synthetic insulation (Type SN) to be permissible in size up to No. 4/0 will be available for feeders, as well as branch circuits. Industry will have wires to fit rewiring needs. And into these pipes may be drawn conductors up to 50 per cent conduit fill, a 25 per cent increase over the regulation governing new work.

EXAMPLE NO. 1. STORE BUILDING

A store 50 feet by 60 feet, or 3,000 square feet, has 30 feet of show window.
Computed Load:

General lighting load: 3,000 square feet at 3 watts per square foot	9,000 watts
Show window lighting load: 30 feet at 200 watts per foot	6,000 watts

**MINIMUM NUMBER OF BRANCH CIRCUITS REQUIRED (Section 2107):
General Lighting load: 9,000 ÷ 230 = 39 amperes for 3-wire, 115-230 volts; or 78 amperes for 2-wire, 115 volts.

Two 25-ampere, 2-wire and two 15-ampere, 2-wire circuits; or
One 25-ampere, 3-wire, and one 15-ampere, 3-wire circuit; or
Six 15-ampere, 2-wire circuits or
Three 15-ampere, 3-wire circuits.

Special lighting load (show window): 6,000 ÷ 230 = 26 amperes for 3-wire, 115-230 volts; or 52 amperes for 2-wire, 115 volts:

Four 15-ampere, 2-wire circuits, or
Two 15-ampere, 3-wire circuits.

MINIMUM SIZE FEEDERS (or Service Conductors) REQUIRED (Section 2203):

For 115-230-volt, 3-wire system:
Ampere load: 39 + 26 = 65 amperes. Size of each feeder, No. 3.
For 115-volt system:
Ampere load: 78 + 52 = 130 amperes. Size of each feeder, No. 3/0.

**In stores and similar occupancies where practically the entire load is likely to be used for long periods of time, the loading of the circuit shall not exceed 80 per cent of the branch circuit rating. Section 2107. Therefore, in such installations the number of branch circuits shall be increased accordingly.

EXAMPLE NO. 2. BRANCH CIRCUITS

GENERAL LIGHTING. For general illumination in the occupancies shown in the following table, a load of not less than the "watts per square foot" as specified for each occupancy shall be included for each square foot of floor area (Section 2108a):

OCCUPANCY	WATTS PER SQUARE FOOT
Apartments and Multi-Family Dwellings*	2
Armories and Auditoriums	1
Banks	2
Churches	1
Clubs*	2
Dwellings, Single-Family*	2
Hospitals	2
Hotels*	2
Office Buildings	2
Restaurants	2
Schools	3
Stores	3

In any of the above listed occupancies, except single-family dwellings and individual apartments of multi-family dwellings:

Assembly Halls and Auditoriums	1
Hallways, Corridors and Closets	½
Storage Spaces	¼

For general illumination in occupancies not listed above, the load shall be computed in accordance with the provisions of sub-paragraph d of this section.

Feeder Design Affected

The decrease in ampere rating of large conductors will show up in layout work. Using Type R (Code grade) wire, instead of figuring, as at present, on a 2½-inch conduit with four No. 4/0 for a 225-ampere, 3-phase, 4-wire load, we will be estimating on the basis of a 3½-inch raceway with four 400,000 CM conductors. In such cases, it becomes important to consider using a superior insulation. For example, we could install a 3-inch conduit and four 300,000 CM Type RP wires good for 238 amperes; or, we could revert to our original 2½-inch pipe and four 4/0's if we were to employ type RH, rated 230 amperes. These options on wire size bring us to the matter of voltage drop.

The 1940 issue will set one per cent as the feeder drop which should not be exceeded on lighting loads. Referring to the above case, No. 4/0 could carry 225 amperes for 105 feet without exceeding one per cent drop. The 300,000 CM set-up would carry this same current for 145 feet, and 400,000 CM for 195 feet at one per cent. So, on long feeders, the large cables might become necessary on account of voltage drop.

Cellular Floor Raceways

Included with the 1940 recognized wiring methods is a new article on cellular metal floor raceways which is most noteworthy in this respect, that it involves the use of the building structure as raceways for the installation of electrical conductors.

The rules on the application of this newly recognized wiring method govern the electrical usage of a cellular structure of hollow steel floor beams, or "cells," in conjunction with transverse raceways, or "headers," providing access to the cells. The new article follows

immediately after the underfloor raceway article, and to which it is quite similar in style and wording, regulating as it does the maximum size and number of conductors, the installation of suitable markers for the locating of cells, the levelling and bonding of junction boxes, and the cutting and sealing of inserts into the cells. Cellular metal floor raceways have a peculiar application, they may not be used in commercial garages except for supplying outlets below the floor but not above.

Now, at the outlets, a noteworthy change will permit the connection of a medium-base lamp on a 20-ampere circuit where the lampholder is of the keyless type and is part of a permanently-connected lighting unit controlled by a switch. In 1937 such a lampholder had to be part of a unit using mogul lampholders.

Flush and Recessed fixtures must hereafter be of an approved type. The 194° F. top temperature remains, but new regulations call for ½-inch spacing from combustible material; and special attention must be paid to the wiring of these fixtures with the introduction of the four-foot minimum and six-foot maximum rule applying to the high-temperature conductors at any point along the line between the outlet and the fixture.

Another utilization for electricity will be regulated by new rules in the sign article, wherein will appear equipment and installation rules for inside lighting with high-voltage gas tubes.

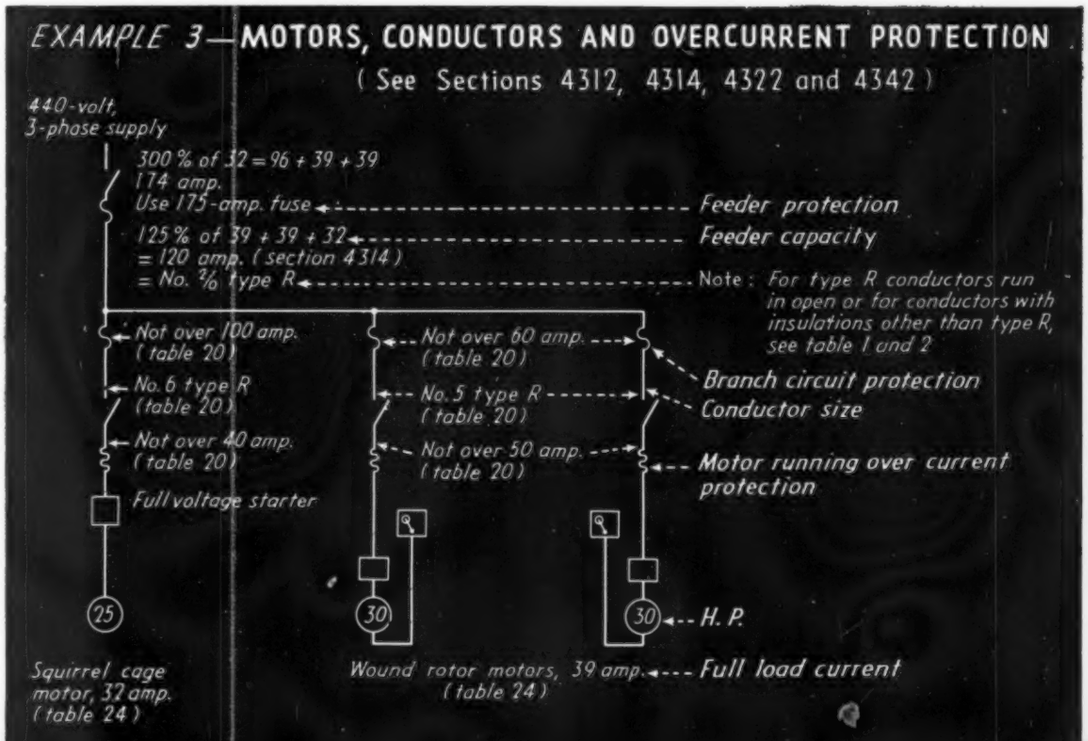
II. Code Changes Affecting Industrial Wiring

New Code requirements cover services, circuits and equipment over 600-volts; transformers and vaults; overcurrent protection; grounding motors and control; hazardous locations; cranes and hoists; as well as wiring methods and materials. Current capacity of conductors important here.

THE revised current ratings of wires and the many new types of insulated conductors receiving Code recognition will probably effect a big change in industrial wiring practice when the new Code becomes effective. The adoption of the Identifying Code letters of the National Electrical Manufacturers Association which are to show motor locked-rotor input should give closer overcurrent protection on motor circuits, and is an important change as is the rewritten rule to require the grounding of portables. Noteworthy also are the new requirements for the installation of disconnecting means ahead of the higher voltage fuses and cutouts.

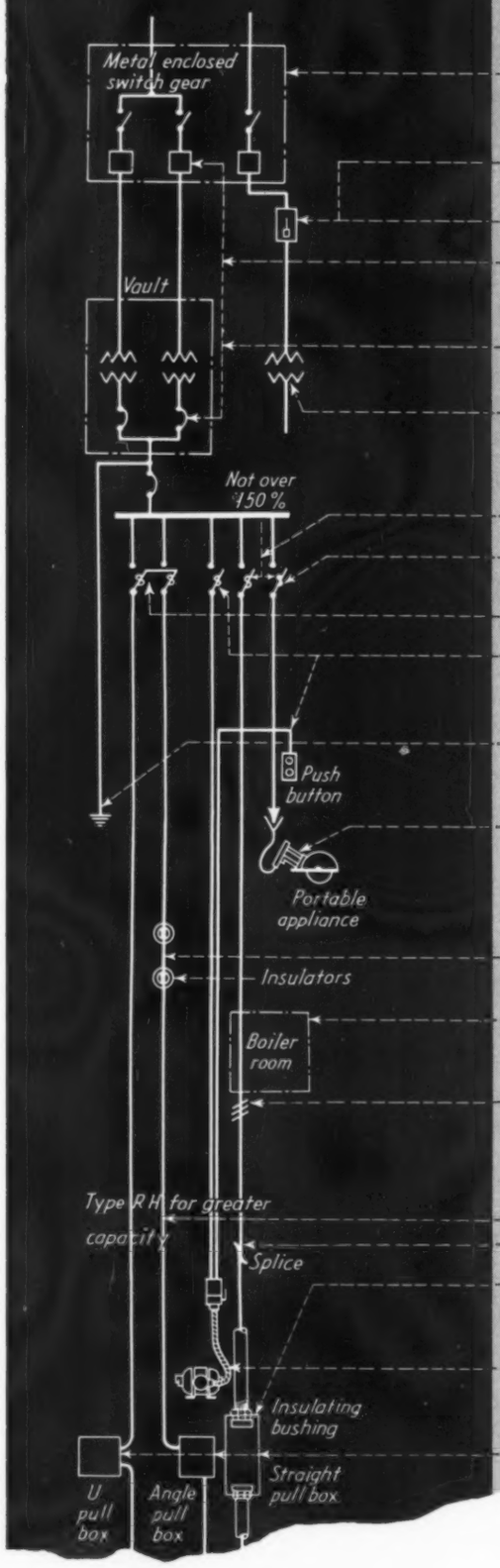
In industry we run into all the four variables on current capacity of conductors. There are many hot locations where the high room temperatures will decrease allowable capacities in accordance with the new ambient factors included with the capacity tables. The other decreasing factor occurs where there are four or more conductors in a raceway or cable. On the other hand, by the employment of superior grades of insulation we can very markedly increase wire capacity; and the same result it might be said can be obtained by installing conductors in free air (open-wiring).

Type AI impregnated asbestos, one of the newly recognized insulations, will serve to illustrate how these new products will fit industry's need. Its limiting temperature is 125° C., and it is available for use in dry locations, but not for general conduit installation. Its capacity in the open at 30° C.


EXAMPLE 3—MOTORS, CONDUCTORS AND OVERCURRENT PROTECTION
(See Sections 4312, 4314, 4322 and 4342)
440-volt, 3-phase supply
300 % of 32 = 96 + 39 + 39
174 amp.
Use 175-amp. fuse
Feeder protection
125 % of 39 + 39 + 32
= 120 amp. (section 4314)
= No. 3/0 type R
Feeder capacity
Note: For type R conductors run in open or for conductors with insulations other than type R, see table 1 and 2
Not over 100 amp. (table 20)
No. 6 type R (table 20)
Not over 40 amp. (table 20)
Full voltage starter
Not over 60 amp. (table 20)
No. 5 type R (table 20)
Not over 50 amp. (table 20)
Branch circuit protection
Conductor size
Motor running over current protection
25
30
30
H. P.
Squirrel cage motor, 32 amp. (table 24)
Wound rotor motors, 39 amp. (table 24)
Full load current

INDUSTRIAL WIRING—1940

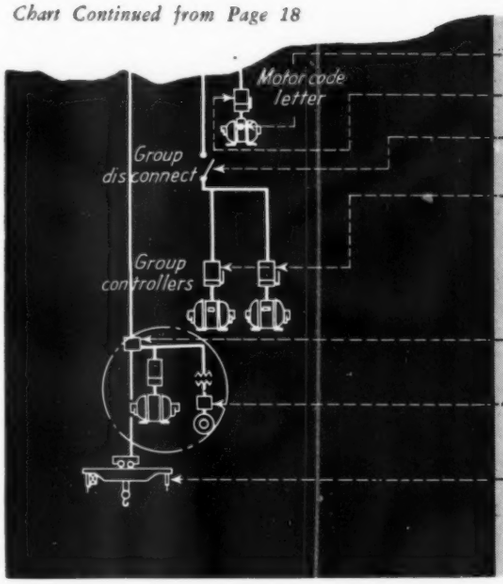
CHART ILLUSTRATING SOME OF THE PRINCIPAL CHANGES IN THE 1940 NAT. ELEC. CODE



	CODE SECTION
SERVICES—ART. 230	
Over 7.5 kv., service conductors shall enter a vault except that when service equipment consists of metal-enclosed switchgear not over 15 kv. vault is not required.	2387
CIRCUITS & EQUIPMENT OVER 600 VOLTS—ART. 710	
Control apparatus over 5 kv. shall have metal enclosure, or must be installed in a special room or vault.	7135
If exposed live parts over 600 v. are accessible by a door, it shall be locked so that it cannot be opened by unauthorized persons, or interlocked to prevent opening unless parts deenergized.	7135
Transformers operating in multiple to be separately protected on both primary and secondary sides.	7141
TRANSFORMERS & VAULTS—ART. 450	
Ventilation to be provided on basis of 3 sq. in. per KVA of transformer capacity. Minimum one sq. ft.	4525
Transformer over 25 KVA having liquid that will not burn to have pressure-relief vent. If location is poorly ventilated, this vent must carry gases outdoors or gas-absorption means to be installed.	4503
OVERCURRENT PROTECTION—ART. 240	
In case allowable capacity does not match standard fuse or breaker, next larger size may be used up to 150% allowable capacity.	2403
Independent disconnecting means to be provided for each fuse or cutout circuit over 150 v. to ground which is accessible to unqualified persons. Disconnecting means to be so arranged that fuse or cutout will be dead before it can be touched.	2440
A single disconnecting means may serve a group of fuses or cutouts where a number of motors drive a single machine.	2440
Time-lag protective devices not to be acceptable with provision that allows up to 500% conductor capacity for remote-control circuits.	2403
GROUNDING—ART. 250	
Size of grounding conductor for a System, Common or Service Equipment ground to be not less than stipulated size based on size of largest service conductor. No. 3/o, 1" conduit or pipe, and 2" E.M.T. largest sizes listed.	2594
In other than residence occupancies, exposed metal parts of portable appliances used in damp or wet locations, or by persons standing on the ground or a metal floor or working inside metal tanks or boilers, shall be grounded, except where supplied through an insulating transformer with ungrounded secondary of not over 50 volts.	2545
WIRING METHODS & MATERIALS—ART. 300	
Open wiring good for more than raceway or cable work.	
4/o type R in pipe or cable=160 amp. @ 30° C.	Table 1
4/o type R in free air=248 amp. @ 30° C.	Table 2
High ambient cuts down capacity. Say room temperature is 45°C.	
4/o type R in pipe or cable=160 x 0.5=80 amp.	Table 1
4/o type R in free air=248 x 0.5=124 amp.	Table 2
Number of wires in raceway or cable also cuts down capacity.	
1-3 4/o type R in pipe or cable=160 amp.	Table 1
4-6 4/o type R in pipe or cable=160 x 0.8=128 amp.	
7-9 4/o type R in pipe or cable=160 x 0.7=112 amp.	
Superior grade insulation allows for greater capacity.	Table 1
4/o type R=160 amp. in pipe or cable, 248 amp. in open.	Table 2
4/o type RP=193 amp. in pipe or cable, 298 amp. in open.	
4/o type RH=230 amp. in pipe or cable, 358 amp. in open.	
Brazed or welded splices recognized.	3009
Where conduit bushings are constructed wholly of insulating material, a locknut shall be provided both inside and outside the enclosure to which the conduit is attached.	3012
FLEXIBLE METAL CONDUIT—ART. 350	
Not to be used where rubber-covered conductors are exposed to oil, gasoline or other materials having a deteriorating effect on rubber.	3502
OUTLET BOXES, ETC.—ART. 370	
For raceways 1¼" and larger, minimum sizes of pull boxes to conform to new rules. See separate sketches.	3706

Chart Continued on Page 19

Chart Continued from Page 18



MOTORS & CONTROLLERS—ART. 430

Motors to be marked with code letter to show their KVA input with locked rotor, to be used in determination of branch circuit overcurrent protection.	4304
Overcurrent protection of automatically started motors ⅛—1 H.P. limited to 140% motor rating.	4322
The disconnecting means serving a group of motors shall have a rating of not less than is required for a single motor whose rating equals the sum of the horsepowers or currents of all the motors of the group.	4410
Where 2 or more motors are connected to the same branch circuit, the controllers as well as the motor running overcurrent devices must be approved for group operation.	4343
150% motor rating has been set as the limit on motor protective devices, where protection values specified do not correspond to standard sizes.	4324

HAZARDOUS LOCATIONS—ART. 500

Paragraph on sealing has been increased by its application to conduits 4" and larger at terminal and junction boxes, and also to drainage of condensate in explosion-proof sumps.	5014
Signal and communication equipment included.	5027

CRANES AND HOISTS—ART. 610

Track may be used as circuit conductor for 3-phase power system under certain conditions.	6121

is 126 and 476 amperes for No. 6 and 4/0 respectively, compared to old Column C "Other Insulations" wherein these sizes are now rated 70 and 325 amperes.

From the installer's viewpoint a most interesting rule is 3706 on the minimum sizes to be provided in pull boxes where pipes or tubes 1¼-inch and larger are involved. See example No. 5 for sample computations. The possibility of damaging conductors while installing them in boxes of inadequate dimensions is well known. Speaking of installations, enamelled iron raceways or fittings may no longer be used outdoors.

Motor circuit protection is to be more closely regulated, and hereafter the size of fuse we can use in a motor branch will depend on the same conditions as at present—type of motor and starting equipment—and also upon the particular motor Code letter involved. For instance, a 50-ampere machine full-voltage starting may have its branch fused up to 150 amperes for an F to R grade motor, but only to 125 amperes for one from the B to E class. If it is of the highest grade A (lowest locked-rotor current) the fuse in the branch is limited to 80 amperes.

Contractors and others would do well to familiarize themselves with the new rules on the need for disconnecting means where fuses and thermal cutouts over 150 volts to ground are generally accessible, paragraph 2440. Another hazard will be lessened when portable appliances are grounded as called for in the 1940 Code, or supplied through an insulating transformer on an underground circuit of not over 50 volts.

III. Code Changes Affecting Residential Wiring

New Code alters previous rules for service, grounding, feeders, overcurrent protection, branch circuits, outlet boxes, switches, fixtures and receptacles, appliances and wiring methods. Radical revision in protection of wire, adequacy requirements extended.

RESIDENTIAL wiring calculations will be simplified in the 1940 National Electrical Code, which will extend adequacy requirements in dwellings and call for the use of tamper-proof fuseholders to protect conductors at the new values of current which the 1940 issue will assign to the old and new types of conductor insulations.

The most radical change will come in the protection of wires. Hereafter, instead of a conductor being good for a fixed ampere value, its current-carrying capacity will vary depending not only on the grade of insulation but where and how we install it. However, in residential wiring, the new temperature limitations should not be troublesome unless, of course, we should want to run wires through some hot place like the boiler room of an apartment house. Nor should the restrictions to be imposed where there are more than three wires in a pipe or cable upset house-wiring practice which is confined largely to two- and three-wire circuits. There should be little question as to conductor capacities on account of the particular wiring method to be employed for the reason that the higher values of Table 2 will be applicable only to single conductors in free air (open wiring, knob-and-tube work); whereas with all other raceway or cable systems, the lower values of Table 1 are to be used. This leaves the grade of insulation as the main consideration affecting wire capacities in residential wiring. For instance, No. 12 will be rated at 20, 23 or 27 amperes for rubber insulation Type R, RP or RH respectively. Likewise, No. 6 will be good for 45, 54 or 65 amperes.

In the matter of applying current capacity rules, voltage drop must not be overlooked, and the new Code sets

a drop of one per cent as the limit which should not be exceeded in lighting feeders, or feeders for combined lighting and power loads.

Now regarding overcurrent protection for wires, such foregoing odd values of current are not matched by the standard ratings of overcurrent devices, so an allowance will be made that the next larger fuse or breaker may be used, provided it does not exceed 150 per cent of rated conductor capacity.

Type S will be the new designation for the tamper-resisting fuse, the standard type to be known as Edison base. Effective November 1, 1941, plug fuseholder installations are scheduled to be limited to the new S type.

Wiring Requirements

Additional minimum wiring requirements will be introduced. Not less than No. 12 wire is to be used to supply receptacles in the kitchen, laundry, pantry, dining room and breakfast room, and such circuits are restricted from supplying other outlets. And not less than No. 10 will be required for feeders which supply more than a certain number of branch circuits (see chart on page 21).

In the 1937 Code, the residential standard of 2 watts per square foot for branches, and one watt for feeders has been somewhat confusing. The 1940 plan of using only one value—2 watts—but with different demand values for branches and for feeders should be helpful. A flat appliance allowance of 1500 watts will be required for dwellings; with this exception, that for one-family houses of less than 1000 sq. ft. floor area, this allowance may be cut down to 1000 watts. See Example No. 4 for a typical analysis.

The rule on receptacles (2110) has been amended so that one receptacle will be required for every 20 linear feet of wall space or major fraction thereof, with the requirement that these receptacles be spaced equal distances apart, in so far as practicable.

The new restriction against the installation of enamelled iron conduit outdoors will in effect require the use of galvanized service pipes. An important conduit fill exception will permit the installation of three No. 8 insulated conductors in a ¾-inch service conduit or tube. As to grounding, it is noteworthy that under the new Code grounding connections which depend upon solder shall not be used.

EXAMPLE NO. 4. SINGLE-FAMILY DWELLING

Dwelling having a floor area of 2,500 square feet, exclusive of unoccupied cellar, unfinished attic and open porches.

COMPUTED LOAD (Section 2108):

Lighting load	5,000 watts
Appliance load	1,500 watts
Total computed load	6,500 watts

MINIMUM NUMBER OF BRANCH CIRCUITS REQUIRED (Section 2107):

General lighting load: 5000 ÷ 115 = 43 amperes, or three 15-ampere, 2-wire circuits.
Small appliance load: 1500 ÷ 115 = 13 amperes, or one 2-wire circuit of No. 12 wire (See section 2109).

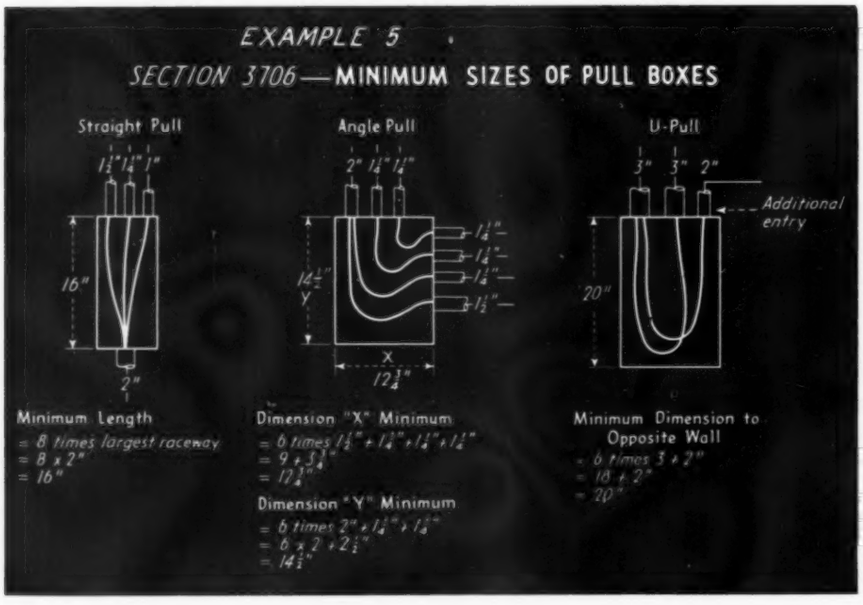
MINIMUM SIZE FEEDERS (or Service Conductors) REQUIRED (Section 2203):

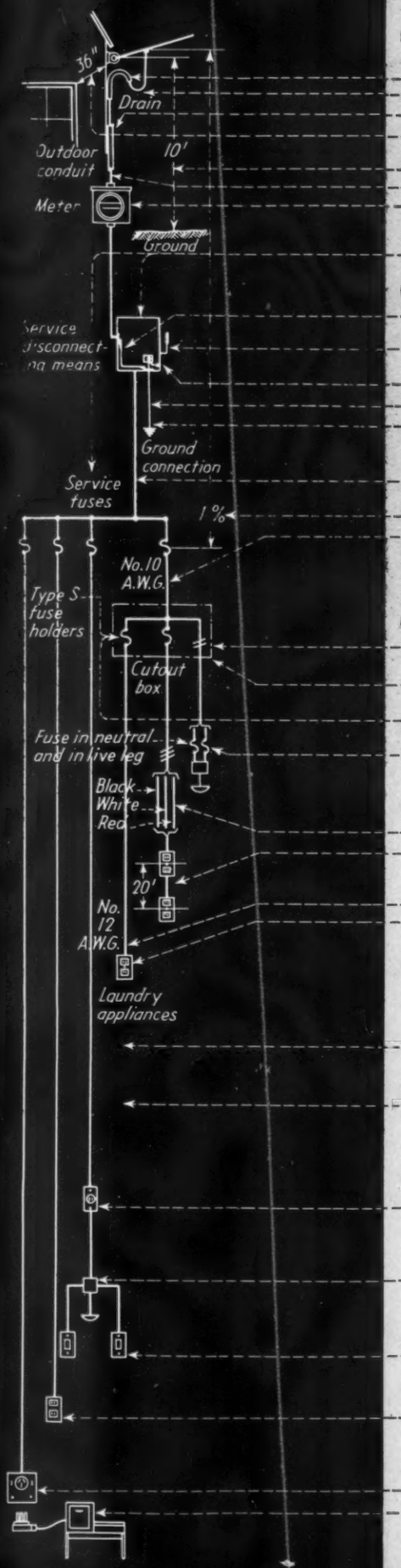
Total computed load	6,500 watts
2,500 watts at 100%	2,500 watts
4,000 watts at 30%	1,200 watts
Net computed load	3,700 watts

For 115-volt 2-wire system:
3,700 ÷ 115 = 32 amperes, or No. 8.
For 115-230-volt, 3-wire system:
3,700 ÷ 230 = 16 amperes, or No. 8. For minimum size conductor, see sections 2201 and 2305.

MINIMUM NUMBER RECEPTACLES REQUIRED (Section 2110):

Living Room: 16 feet by 22 feet; 76 feet total (gross) distance around the room. 76 feet ÷ 20 = 3.8 or 4 receptacles.
Each Bed Room: 14 feet by 15 feet; 58 feet total (gross) distance around the room. 58 feet ÷ 20 = 2.9 or 3 receptacles.
*Dining Room: 16 feet by 16 feet; 64 feet total (gross) distance around the room. 64 feet ÷ 20 = 3.2 or 3 receptacles.
*Breakfast Room: 10 feet by 12 feet; 44 feet total (gross) distance around the room. 44 feet ÷ 20 = 2.2 or 2 receptacles.
*Kitchen: 14 feet by 14 feet; 56 feet total (gross) distance around the room. 56 ÷ 20 = 2.8 or 3 receptacles.
Note 1. Receptacles to be placed equal distances apart insofar as practicable.
*Note 2. Receptacles in these locations, also laundry, to be supplied by circuit or circuits of not less than No. 12 wire. (Section 2109.)





RESIDENCE WIRING — 1940

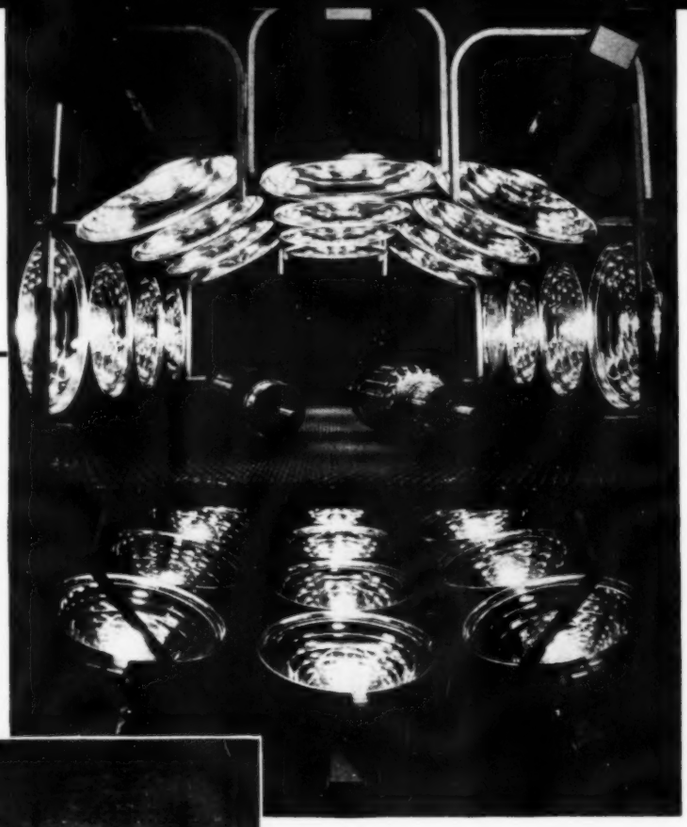
CHART ILLUSTRATING SOME OF THE PRINCIPAL CHANGES IN THE 1940 NAT. ELEC. CODE

	CODE SECTION
SERVICES—ART. 230	
Service cable gooseneck to be secured by fitting, or by connection to service drop conductors below the gooseneck.	2337
Drain service-entrance conductors by removing insulation.	2337
Enamelled pipe and fittings not to be installed outdoors.	3019
Service Drop to be at least 36 inches from readily-accessible windows, doors and porches.	2324
Service Drop to clear sidewalk by 10 ft., with special proviso for low buildings.	2325
Bare Neutral limit 208 volts to ground (was 150).	2304
Meter Enclosure on supply side of service equipment may be grounded to neutral.	2382
Service fuses to be integral with switch or located immediately adjacent thereto.	2372
GROUNDING—ART. 250	
Bonding jumpers to be installed where punched knock-outs are used in service equipment.	2572
Each distribution system to have at least one additional ground at transformer or elsewhere.	2523
System ground may also be used for equipment.	2553
System ground wire may be bare.	2591
Only Solderless connections to be permissible with grounding conductors.	2613 2614
FEEDERS—ART. 220	
Feeder which carries total current of service of No. 8 or smaller to be same size as service-entrance conductors.	2201
Voltage Drop should not exceed 1% for lighting loads.	2202
Not less than No. 10 to be used to supply: 2 or more 2-wire branches on 2-wire feeder. 2 or more 3-wire branches on 3-wire feeder. 3 or more 2-wire branches on 3-wire feeder.	2201
OVERCURRENT PROTECTION—ART. 240	
Cutout enclosures in damp or wet locations to be of approved type, and mounted ½" from surface.	2437
Cabinets and cutout boxes which contain more than eight conductors shall have wiring spaces or gutters.	93706
After Nov. 1, 1941, only Type S (tamper-proof) plug fuseholders to be installed.	2452
Existing 2-wire branch circuits to have a fuse or circuit breaker in each leg unless all lampholders are polarized.	2409
BRANCH CIRCUITS—ART. 210	
Multi-wire branches to be color-coded (cable wiring systems not included).	2104
Receptacle to be provided for every 20 ft. of wall space or major fraction thereof.	2110
No. 12 or larger to be used to supply receptacles in kitchen, laundry, pantry, breakfast and dining rooms. Not to supply other outlets.	2109
At least one receptacle to be installed for laundry appliances. *Note:* Common branch circuit neutral no longer permissible.	2110
WIRING METHODS, GENERAL—ART. 300	
Selection to be made from 19 types of conductor insulations.	3005
Current-Carrying Capacities changed.	Tables 1&2
KNOB-AND-TUBE WORK—ART. 324	
Conductors may be types R, RP or RH (RP and RH new).	3243
ARMORED CABLE—ART. 334	
Not to be used in theatres, motion-picture studios, nor where exposed to corrosive fumes or vapors.	3342
NON-METALLIC SHEATHED CABLE—ART. 336	
Switch, outlet and tap devices of insulating material may be used without boxes in exposed wiring.	3368
OUTLET BOXES, ETC.—ART. 370	
Metallic boxes used with knob-and-tube work or non-metallic sheathed cable to be insulated from metal walls and ceilings, or shall be grounded.	3701
SWITCHES—ART. 380	
3- and 4-way switches to be wired into ungrounded leg only.	3802
FIXTURES AND RECEPTACLES—ART. 410	
Ungrounded fixtures and receptacles, including face plates not to be installed within reach of bath tubs.	4105
APPLIANCES—ART. 422	
Demand factors applicable to receptacles.	4245
Range demand factors to be applied only to household appliances.	Table 29

Radiant energy heating is a new industrial process. Here the familiar heat lamp dons overalls. It has opened a profitable new field for electrical contractors among the industries of any city, waiting only for a bit of selling.

Sell INFRA-RED Heat

By W. T. Stuart



TEST TUNNEL *used to determine experimentally the amount of energy concentration and time required for radiant energy processing.*

PRE-HEATING *wood to take glue, this installation eliminated boilers and steam coils.*

CHARACTERIZED by one observer as "taking the hot air out of heating," infra-red radiant energy heating and drying in industry has become one of the brightest opportunities within the electrical horizon. First applied a few years ago to drying automobile finishes in Detroit automobile plants, the last two years has witnessed a phenomenal growth in the applications of the new technique.

Actually the principle is as old as time but its application in industry came about as a result of industrial needs created by new processes. Conveyor belt assembly methods, plastics, quick drying paints and enamels, are some of the contributing developments.

Infra-red heating and drying is electrically simple, easy to apply, and economical. The equipment consists of a bank of lamps and reflectors on close centers. The material to be dried or heated is placed under or passed through the bank of light. The radiant energy from the lamp filaments, emitting approximately 90 per cent of their energy in the infra-red band of the spectrum, heats the material directly by radiation.

As the temperature of the surrounding air is not a significant factor in the heating process infra-red "ovens" require no enclosure or heat insulation. Only a framework, sturdy enough to support the lamps and reflectors, is required for mounting. The conventional radiant energy heating bank or "tunnel" consists of a group of highly efficient reflectors and carbon or tungsten lamps designed to radiate most of their energy in the infra-red portion of the spectrum.

The reflectors are 7½ to 11 inches in diameter and highly concentrating. Surfaces are gold plated for highest concentration and efficiency, Alzak aluminum where frequent cleaning is required.

Design Factors

Heretofore, industrial process drying in ovens, whether gas, electric or steam, has been regulated according to temperature and time. But with radiant drying the temperature of the treated object is not readily determined. In a study of radiant energy heating by the Utilities Research Commission, an organization sponsored by the Commonwealth Edison group of companies in the Chicago area, it has been proposed to rate all drying operations by energy concentration on the surface to be treated (measured in watts per sq. in.) and time in minutes. In the accompanying table the reflector spacing and the distance to the work using a 260-watt, 120-volt carbon filament drying lamp gives the average watts per sq. in. energy concentration, as measured by a thermopile.

Infra-red lamps for finish curing and moisture drying are available with carbon or tungsten filaments. The carbon lamps are rated at 240-, 260-, 375-watts, the most popular today being the 260-watt. The tungsten filament lamps are rated at 250-, 500- and 1,000-watts, the two larger equipped with medium bipost bases.

In earlier infra-red drying experiments the infra-red system was applied to paints and lacquers designed for drying in a conventional baking oven. Already the paint manufacturers are developing finishes designed particularly for infra-red drying.

Both enamels and lacquers are suitable for radiant drying. Lacquers ordinarily dry in air in a period of from 15 minutes to 1 hour, whereas enamels

Daddy! Why is the top of the world so Dirty?

That dust settles upon horizontal surfaces and not on vertical surfaces is a simple fact—but an important one to users of Motor Control. For Motor Control contacts can cause a lot of trouble unless they *stay* clean, free from dust and dirt. And it seems almost beyond argument that Motor Control with *vertical* contacts which *can't* collect dust and dirt are sure to identify Motor Control that will be more dependable, will last longer, will cost less to operate . . . on *all* your motors.

If you agree, you *must* standardize on Cutler-Hammer Motor Control for your own protection—for this is the *one* make of Motor Control that uses dust-safe vertical contacts *exclusively*. Specify Cutler-Hammer and *see* the difference. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers*, 1306 St. Paul Avenue, Milwaukee, Wisconsin.

Cutler-Hammer vertical contacts are the mark of better Motor Control, another extra dividend on C-H's unequalled specialized experience and decades of Motor Control leadership.

CUTLER-HAMMER
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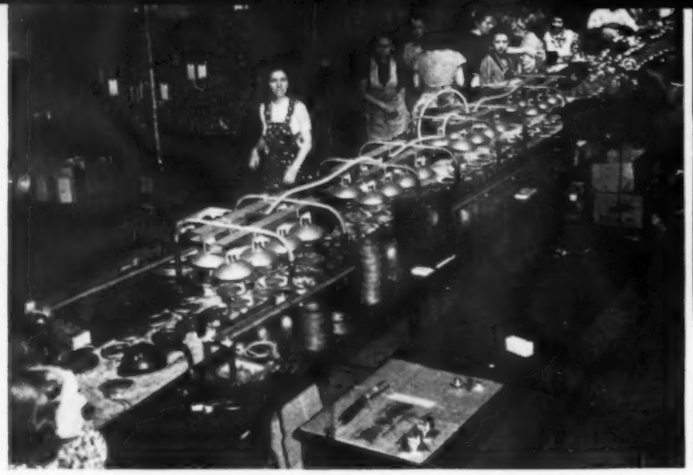
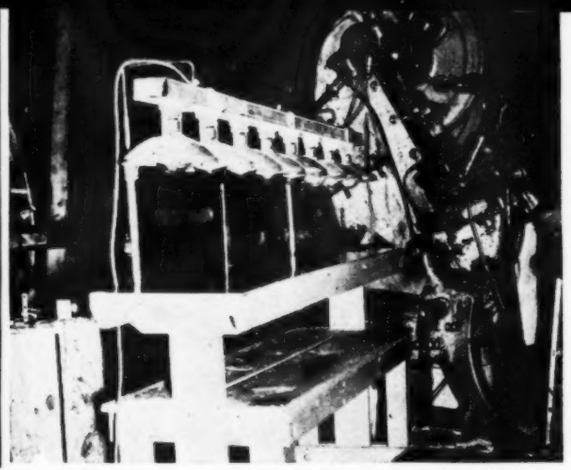
Dust Safe VERTICAL *Contacts*



DRYING LACQUER *and glue on conveyor line assembly of radio speakers. The conveyor passes under a bank of heat lamps.*



PLASTIC SHEETS *are softened by radiant heat before punching*

require from 8 to 10 hours to dry hard. Enamels dry by a chemical change or hardening of the resin necessary to give a hard finish. Lacquers dry almost wholly by evaporation of the solvent and care must be used not to overheat the lacquer which would cause bubbles and pin-holes. In other words, while enamels may stand quite high energy concentration, a relatively low value should be used on lacquers.

In general, lamp drying of lacquers and enamels requires only from two to 15 minutes depending upon energy concentration. This is in comparison with a typical allowance of from one to four hours in an oven. In many cases lamp drying avoids shutting down machinery in establishments where the humidity at certain times of the year is such that it is impossible to dry the product.

While a great majority of curing jobs refer to metal objects there are many cases of finished wood panels, furniture and molded articles. Here the heat conduction away from the surface, through the material itself, is much less rapid so that more care must be exercised to avoid burning the finish.

In general, higher concentrations of energy in longer time intervals are required for moisture drying than for the curing of finishes. This is due to lower volatility of water, greater thickness of the layer to be dried out, low heat conductivity of the material.

Typical Installations of Radiant Energy Heating

	No. of lamps	Reflector	Spacing	Distance to work	W/sq. in.
Synthetic lacquer on wood pencil barrels	10-240 W	8¼″ Alzak	14.4 in.	12 and 18 in.	1.8 & 1.4
Softening plastic parts for punching	16-240 W	8¼″ Alzak	8½ in.	12-24 in.	0.9
Drying filler on fabric stencils	56-260 W	7½″ color aluminited	7½ in.	6 in.	3.4
Drying inside of metal caskets	10-260 W	Special arrangement		3-8 in.	0.4
Lacquer ink on game pieces	38-240 W	8¼″ Alzak	8½ in.	12 in.	1.33
Drying Tenite granules before molding	24-260 W	7½″ color aluminited	7½ in.	12-36 in.	1.33 to 0.66
Removing cyanide from pits in castings	24-260 W	8¼″ Alzak	8½ in.	7 in.	3.2
Inks on printed paper stocks	12-260 W	10″ Gold	10 in.	4 in.	3.4
Expanding aluminum alloy pistons	4-260 W	7½″ color aluminited	7½ in.	6 in.	3.25
Baking finish on transformer cases	30-260 W	10″ Gold	12 in.	8 in.	3.5

Watts Per Square Inch Energy Concentration

In Terms of Reflector Spacing and Distance from Work Using the 260-Watt 120-Volt Carbon-Filament Drying Lamp

Filament Height Above Work	Lamp Spacing	No. of Lamp Bars	No. of Lamps per Bar	Total No. of Lamps	Avg. Watts per Sq. In.	Comments
6 Inches....	8¼″ x 8¼″	2	4	8	3.00	Staggered reflectors. All in 1 plane above the work.
		3	4	12	3.25	
		4	4	16	3.40	
12 Inches....	8¼″ x 8¼″	2	4	8	2.34	" "
		3	4	12	2.65	
		4	4	16	2.79	
18 Inches....	8¼″ x 8¼″	2	4	8	1.72	" "
		3	4	12	2.00	
		4	4	16	2.18	
6 Inches....	8¼″ x 8¼″	2	4	8	2.87	Oppositely positioned reflectors. All in 1 plane above work.
		3	4	12	2.93	
		4	4	16	3.06	
12 Inches....	8¼″ x 8¼″	1	4	4	1.33	
		2	4	8	1.83	" "
		3	4	12	2.18	
		4	4	16	2.27	
18 Inches....	8¼″ x 8¼″	1	4	4	0.90	
		2	4	8	1.50	" "
		3	4	12	1.80	
		4	4	16	2.00	

Installation

Here is one example of the kind of jobs available to contractors in this field. At the Statten Furniture Company's Chicago woodworking shop, the James E. Rust Electric Co., electrical contractors, installed a bank of infra-red lamps for pre-heating wood before glue is applied. This is a simple operation where no critical treatment is required. The wood blocks are laid on a long bench directly under the lamp and are heated for three or four minutes. Then, the glue is applied and the pieces are clamped together.

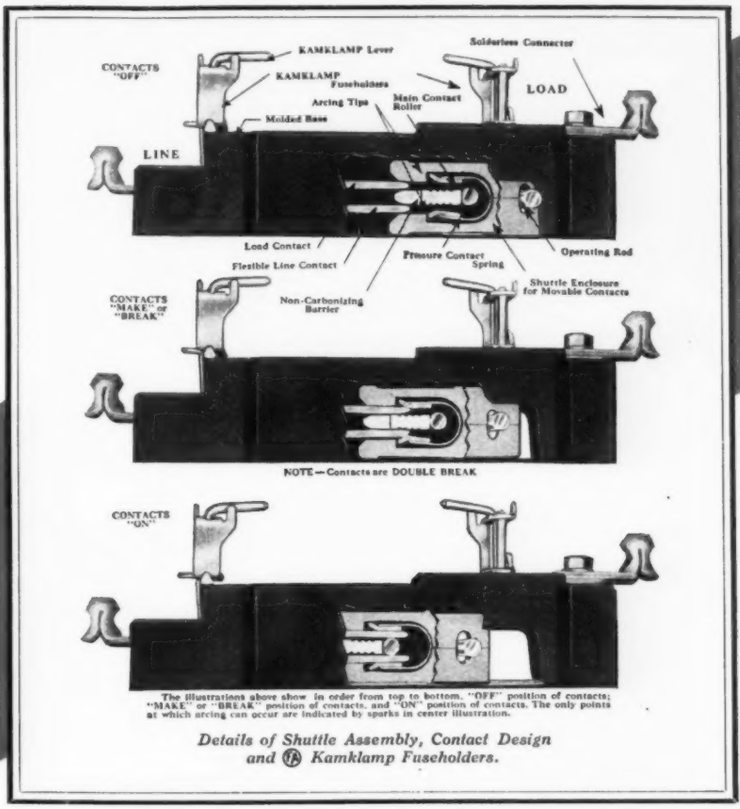
One of the principal considerations in this installation was economy. Previously the wood was heated by steam coils which required a boiler in operation all day through every working day of the year. The gluing work, however, is periodic and irregular depending upon operations in other parts of the plant.

The installation of the infra-red lamp bank provides instant heat as soon as the switch is closed, a shorter heating period and no maintenance. This

[Continued on Page 74]

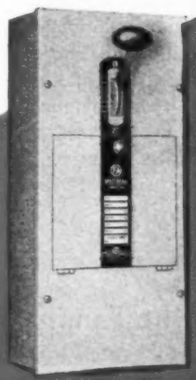
Something New . . .

in an ENCLOSED SAFETY SWITCH

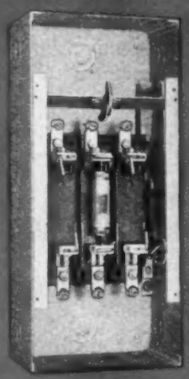


The illustrations above show, in order from top to bottom, "OFF" position of contacts; "MAKE" or "BREAK" position of contacts, and "ON" position of contacts. The only points at which arcing can occur are indicated by sparks in center illustration.

Details of Shuttle Assembly, Contact Design and (FA) Kamklamp Fuseholders.



Type A, in ON position; door interlocked with handle—fuses not accessible when ON.



Type A, with front removed.

Type B, in OFF position; non-interlocking door—fuses accessible in either ON or OFF position.

Here is a front-operated safety switch which embodies *entirely new ideas in both design and construction.*

The (FA) Shutlbrak Enclosed Switch is a high quality, heavy duty industrial switch for motor control, service entrance, and other disconnect installations. Its quick make and break connections are *held under compression.* It is equipped with Kamklamp fuseholders for either the ferrule or knife-blade types of fuse terminals.

The line and load connections are enclosed in the completely insulated shuttle, which contains the movable contacts—the auxiliary contacts on the ends of the compression spring, and the main contact roller. There is an arc-resisting barrier between the line and load contacts *at all times.*

The switchbox has ample room at top, bottom and *behind* the switch unit for wiring and connecting space.

The (FA) Shutlbrak Switch is available either with or without an interlocking arrangement between the operating switch lever and the door of the fuse compartment. It may be had for either surface or flush mounting.

Capacities at present: 30 to 200 amp., inclusive, for 250 volts AC or DC, and 575 volts AC, in 2, 3 and 4 poles. (Larger capacities in preparation.) Each switch is rated in horsepower. Approved by Underwriters' Laboratories as an Enclosed Switch.

The (FA) One-Piece Panel Switchboard When (FA) Shutlbrak Switches are mounted for switchboard assembly, each steel panel is self-contained, with all of the switch units connected to the branch bus bars of that section. These branch bars are connected to a vertical set of bus bars, which are in turn connected to horizontal bus bars. The latter are supported at either top or bottom, whichever is most convenient to connect the service entrance cables.

The new design (FA) Shutlbrak Switch Switchboard is furnished individually enclosed, with a junction box built into the top of each panel.

For more Complete Information write for Bulletin No. 59; also for *new* Catalog No. 56 . . . Frank Adam Electric Company, St. Louis, Mo.

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ELECTRICAL PRODUCTS

for Industry

FRANK ADAM ELECTRIC CO.

ST. LOUIS, MO. U.S.A.

Earl Whitehorne, Editor

Conventions Pay

Another Convention—This time in Florida. That means, of course, that some of the northern and western men who would normally attend the annual gathering of NECA will not be there. But there will be a larger turn-out from the South. And in the middle of the picture, that group of loyal working members who are always there and always busy.

This electrical construction industry owes a deep debt of gratitude to this group of stalwarts who, despite all discouragement, have kept on with the work. They have kept on not just because they like to go to meetings, not because it pleases them to be prominent in association affairs, but because they believe it is worthwhile. They know it is vital that we have official leadership in this industry, to promote progress and to defend our interests. Their time and effort have been given willingly for the common good and fortunately no man who engages in this work fails to find practical benefit to pay him for what he does.

The fact that the association needs more active members, more workers on committees is not the important point. There are a lot more contractors in this country who need the experience of association work. There is no broadening influence in sitting back and criticizing what others do. But men who work learn things and go forward.

Those Apprentices

The apprentice problem needs a lot of study. Before long there is going to be a heavy demand for wiremen and for helpers and almost nothing is being done throughout the country to train young men for the wiring trade.

In some localities it is just inertia that holds us back. In others, the union demands a 60 cent rate for first-year apprentices and requires too many journeymen or apprentices. As a result, the contractors find apprentice training too expensive and let it slide.

But we will all lose when the pinch comes. Here is a matter for discussion between the contractors and the local union in every community. It should not be neglected.

Follow It Through

A lot of contracts are now being placed by the Army and Navy involving factory production in a wide variety of industries—metal-working, textile, chemical. The red tape is pulling loose and the work at last is moving.

This means that many old plants are going back into operation. And they are going back to work on new military products that will call for new equipment. Multi-motored machine tools and much other new machinery will demand new motors as more practical than trying to readapt the old machines.

So in many cases the modernizing of old plants for this new work is going to carry with it a surprising amount of new motors, new control, and new wiring. It will involve new layout, new distribution, innumerable unforeseen needs of interest to the electrical contractor. And no man will know at the beginning just what it will lead to.

Same Old Question

When are we going to find a name for three and four-way switches? These terms mean nothing to the public and it slows down the selling.

So it was a few years ago when we talked of baseboard receptacles. We called them receptacles which did not describe either their purpose or their appearance. The public referred to them as plugs. Finally we have all combined on the term "convenience outlet," which at least talks United States. And the mere availability of this understandable term has undoubtedly had a big influence on the increased use of these devices.

There has been too much electrical jargon used in our selling. It has cost us a lot of money. Let's take another step forward now. What shall we call a three-way switch?

Order in the Family

The wife of a Middlewest electrical contractor voiced a complaint the other day that her husband runs a union shop and his workmen quit at 3:30 in the afternoon. Then some of them put in a few hours on their own doing work in competition with the established contractors. Of course it is mostly small commercial and residential new wiring and repairing, but it is a direct drain on this contractor's own business. It forces him to rely on public works and a few large commercial jobs for his livelihood. He loses this incidental small pot-boiling business that should feed a steady income into his shop.

Here is a matter between the local contractors' association in each community and the leaders of the local union. If there is no local contractors association, there ought to be and a local leader to bring them all together.

And There You Are!

A recent report by the Minnesota Electrical Council tells of a survey of 283 contractors with a gross volume of $22,167,160 in 1939. Well, 67 of them lost money. The average profit was just over 3½ per cent. The average overhead was 18 per cent on sales, requiring a mark-up of nearly

24 per cent on prime cost to break even. Yet all over the land are electrical contractors who will take work at 10 per cent mark-up or less!

Of course, this is just giving dollars away. It requires no intelligence, no guts, no ingenuity. And you either go broke or you soak your friends who give you work without competitive bids—until they find it out.

Let Us Agree on This

In Barron, Wisconsin, they have just quit licensing electricians. And why? Well, the "electrical supply dealers opposed the local law because it prevented them from using their own employees to install electrical equipment they might sell." So says the news.

This is a serious matter for the electrical contractors. We want licensing of journeymen and contractors everywhere because it is in the public interest and our own. And surely the reasons should be clear enough to keep the wholesalers on the track. Their interest is the same as ours, to get quality products safely installed. And the contractors of every city should see that local electrical men are in accord on this.

Heat Control Extras

Electrically operated heat control systems are definitely in the class of choice extras. Heat control wiring and installation jobs are usually let to the electrical contractor on the job, sometimes through the heating contractor, sometimes directly by the manufacturer of the equipment. The business comes without competition, if the price is right.

As an industry, it is therefore of some concern to us what kind of heating systems are installed. It is up to us to plug for those systems which mean extra business.

New Customers

No business can hold its own without new customers. For there is bound to be some mortality among the old, no matter how good your service may be. So the selection and selling of new prospects, should be a conscious and organized procedure in every contracting business. And the next few years will be rich in this opportunity.

The preparedness program actually sets the stage for selling new factories. The objective everywhere will be increased production, lower cost, to find ingenious ways to adapt plants to new products. And any man who comes along with ideas of this kind will be not only welcome but well repaid. The smart contractor, therefore, will make a pretty close analysis of the industrial situation in his town and build a list of prospects worth going after. And bear in mind, meanwhile, that it isn't only the plants with war orders that will be in the market. This war work will react in better business for all factories and quicken markets for their products too, whatever they may be. And the selling there will be just as good as in a plant that is making shells.

And About Safety

In many resort communities you can find the worst possible wiring; dime store cords, stapled to rafters and the like. Often there are no facilities for inspection and none required.

An effective reputation builder for contractors wiring in no-inspection communities is a certificate guaranteeing that the job complies with the National Electrical Code. A responsible contractor does that kind of a job anyway and it reassures the owner.

Back Talk

Volume Prices

To the Editor—"In our small community the jobbers have been slowly educating our customers how to buy. Just as slowly has our good business been slipping away.

"We find that any one of our customers has only to employ a man, who at some time in his life might have installed a switch, call him an electrician and say they have an electrical department there, the jobbers burn up their tires getting there to sell him at our costs.

"This thing of having an electrical department covers up a lot of evils. We do not say that large industrials should not buy at a better price, such as Penn Railroad—Bethlehem Steel Co. We believe that something can be done about it.

"We must follow the trend of the times by 'Organizing'. We have a live electric league in this community which has been functioning for about five years or more. If this league could be affiliated with N.E.C.A. as a chapter and if this could be done all over the country, the electrical contractors would have enough weight to make themselves heard."

A Pennsylvania Contractor

By all means handle this through your league. Put it up to the wholesalers that if they want your business they must stick to their function of quantity sales. Discipline those who don't by individually cutting them off and you will get results.

This Inspection

To the Editor—"Help! Help! If old Socrates is in good humor perhaps he'll help us small town electrical workers correct a vicious evil. These smaller cities and towns are in dire need of electrical inspection.

"Can he or you, or some one please tell us how to get this inspection or to force the politicians to enforce the ordinances already in the books?

"Inspection means more jobs and sales for the contractors and of course more jobs for the electricians, too."

Everett M. Strout
IBEW Local 321
La Salle, Illinois

We're for you, Mr. Strout. We need uniform statewide inspection throughout the country and every union local can do well to take leadership in promoting it, where it is now being neglected. Get the local league to work and the contractors. Put it up to the power company. Of course, where local inspectors do not enforce the ordinances, that's something else. Show 'em up.

A Correction

Last month we published a feature article entitled "Electrical Protection in These Times". Albert A. Schuhler, the author, signal engineer with the American District Telegraph Co., now advises us of an unfortunate error in the text as it appeared. On page 18 in the section on "Burglar Alarm Systems" the last two sentences in the paragraph on *Wired Cabinets* should have run as the final two sentences in the paragraph on *Radio Frequency Field*. They read:

"The safe or cabinet must be insulated from the floor and connected to an antenna. Sensitivity is adjustable, also compensation against humidity and temperature conditions."

This refers, therefore, to protection by radio frequency field and is not applicable to wired cabinets. We deeply regret the error and hope it has not led any of our readers astray.

A Few Kind Words

1. **To the Editor**—"I got a great kick out of your editorial 'Cut Worm and Crow' for I haven't heard the old farmers chant of 'one for the blackbird', etc., since I was a kid and planted corn myself.

"I certainly must compliment you upon digging up a lot of these old pertinent sayings which so aptly fit the situation in our industry at the present time. By all means keep up your good work which will undoubtedly result in waking up a great many of the sluggards in our business."

C. M. Munoz, President
Harry Alexander, Inc., New York

2. **To the Editor**—"Thank you for the editorial 'Cut Worm and Crow'. I read this with a great deal of interest. To my mind, this editorial hits the contractors' situation right on the nose."

H. E. Dexter, Vice President
Central Hudson Gas & Electric Corp.
Poughkeepsie, N. Y.

Perhaps we shouldn't show our pleasure at letters like these. But we are human and appreciative—and we are trying to be helpful. Thanks, Mr. Munoz and Mr. Dexter. It is good to know that you are reading these editorials.

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COMMERCIAL & INDUSTRIAL LIGHTING

What To Do

An organized approach breaks down common lighting needs into the simple fundamentals of what is needed and what to use. Also case studies of modern good lighting in factories and other business buildings.

IT is easy to find places to sell lighting to factories and commercial buildings in any city. The trouble is that the average electrical contractor has not done enough of it to develop an easy technique and confident experience in handling factory lighting jobs. He finds it difficult to make a quick analysis of what is needed and to make definite recommendations. But there is a simple procedure that may be followed by any contractor.

After all, there are only three kinds of lighting to use—

a—General Lighting
b—Localized-general Lighting
c—Supplementary Lighting

The trick is to select the right type or combination of lighting for the job and to make the right application of it. To do so, it is first necessary to have clear in mind three other points—

d—What these three types of lighting are for
e—Where they are commonly used
f—What equipment produces them

But all this is easily stated—and can be made clear to the customer with typical photographs.

Industrial Lighting

The designing of a complete lighting system for a factory and the selection of equipment is not as difficult as it would appear. It is true that factories present an infinite variety of processes and machines and materials. But they all combine the same application of illumination to machines, to bench work, to inspection, to office areas and to the other common functions of manufacturing. The lighting of the entire factory therefore combines a variety of lighting usages with which every contractor is familiar.

General Lighting is employed to produce substantially uniform illumination over the entire working area of all types of industrial plants. This type of lighting eliminates the harsh contrast and resultant eye strain which is prevalent when purely local lighting is used over a machine, with the remainder of the working area in comparative darkness.

The reflectors used for general lighting of industrial low bay areas include:

1. RLM dome reflectors
2. Glassteel diffusers
3. Silvered bowl reflectors
4. RLM fluorescent reflectors
5. Explosion-proof and vapor-proof adaptations of the RLM dome units for hazardous locations
6. Adaptations of the RLM dome reflectors for mercury lamps and combination mercury and incandescent lamps.

For general lighting of high bay areas concentrating or spreading type units are commonly used. Some of these are:

1. Porcelain enameled reflectors
2. Alzak aluminum reflectors
3. Prismatic glass reflectors with an aluminum shell
4. Mirrored glass reflectors with an aluminum shell
5. Adaptations of the above units for use with high intensity mercury vapor lamps.

Localized-General Lighting is used in industrial plants where high intensity lighting is needed over large machines or groups of machines or work benches. This type of lighting is necessary in textile mills, print shops, woodworking shops, cleaning and pressing plants, clothing plants, assembly and inspection tables, or in any plant where a lighting level is needed higher than that obtained from the

INDUSTRIAL GENERAL LIGHTING *in this machine shop is provided by standard RLM fluorescent units.*

general lighting system with a uniform spacing and mounting height.

In general, the same type of reflectors are used for this system as for low bay general lighting. But they are mounted closer together and with a lower mounting height. In addition the following units are also used for localized-general lighting:

1. RLM deep bowl reflectors.
2. Large area direct and indirect units for use over drafting, assembly and inspection tables.

Supplementary Lighting is used in conjunction with general and localized lighting to provide high-intensity light at points on a machine or work bench where severe visual discrimination is necessary. It is highly controlled light directed to one particular point on the machine. Its application is found mostly in machine shops and on production machines where close tolerances and accuracy are important.

The needle trades industry uses it extensively and it works well on individual inspection tables where color correction and minute irregularities in the finished product must be checked. In fact it can be used in all industries and applications where the general or localized general lighting systems cannot give high-intensity directed light at strategic points for specific operations.

The types of units used for supplementary lighting include:

1. Industrial concentrators—generally suspended from the ceiling and equipped with louvers or daylight glass covers; projects a high intensity light beam on a concentrated area.
2. Beam-direction attachments—mounted on standard RLM dome reflectors of the general lighting system to direct a concentrated light beam on the machine.
3. Industrial projectors for high intensity lighting of broad horizontal or vertical areas can be mounted on ceiling or on the equipment itself.
4. Reflector and projector lamps which combine a light source and reflector in one glass bulb. These lamps can be used in any socket and project a strong light beam on the desired plane.

Exterior Plant Lighting is used in industrial plants for (a) protection, (b) outdoor work, (c) passageway, driveway and yard illumination and (d) advertising. Most of this type of lighting is done by some form of floodlighting equipment including:

1. Symmetrical or elliptical angle reflectors.
2. Floodlight projectors mounted on buildings, towers or poles.
3. Searchlights with narrow beams, mounted on control and guard towers.
4. Street lighting units mounted on poles along the fence for fence-line lighting.

These systems cover the types of lighting applied to industrial lighting. The system chosen depends upon the specific plant problem and may be either one or a combination of all the systems mentioned. Each individual problem must be carefully studied to determine the proper type of lighting system to be installed.

And in addition to reflector equipment there is, of course, a variety of lamps available in addition to the obvious selection between fluorescent and standard incandescent units. They include—

1. Projector lamps for use where a high level of accurately controlled lighting is required over a restricted area.
2. Silvered bowl lamps available in 60 to 500-watt sizes.
3. The daylight lamp with the same range and wattage.
4. Vibration and rough service lamps available in the 50-watt size.
5. Type H mercury lamps made from 250 to 400 watts in power for general lighting.

The use of these special lamps is often most helpful where unusual and difficult conditions present themselves.

Commercial Lighting

Commercial lighting in stores, offices and drafting rooms employs essentially the same general, localized-general and supplementary lighting systems that are used in industrial buildings. However, lighting these commercial areas is more difficult because of architectural design, the large variety of

IN the preparation of this case study material we have had much helpful cooperation from the Illuminating Engineering Society, the manufacturers of lighting equipment and from many power company lighting men. We have drawn freely from their recent experience in relighting industrial and commercial buildings. And to them, we express our thanks and appreciation.—Editor

fixtures manufactured to blend with the interior store decorations and the vastly different types of merchandise sold. For example, lighting of a clothing department must be treated from an entirely different angle than the illumination of a liquor or bottled goods department.

Office Illumination consists mainly of a general lighting system either of the direct diffusing, semi-indirect or totally indirect types. Supplementary illumination is sometimes used on business machines or other points where critical seeing tasks are performed. The amount of this supplementary lighting depends in a large degree upon the type and intensity of the general lighting system. Fixtures for commercial office lighting are not as standardized as those for industrial work. There are a number of types employing different engineering principles, with numerous design variations of each type. Fixtures commonly used for office lighting include:

1. Totally indirect metal bowl units.
2. Totally indirect units using silvered bowl lamps.
3. Indirect luminous bowl units.
4. Semi-indirect units.
5. Direct prismatic glass units.
6. Direct diffusing glass-enclosed units.
7. Direct and indirect fluorescent units.
8. Fluorescent and incandescent cove lighting units, mostly for private offices.

Unlike industrial plants where direct lighting is a rule, good lighting in commercial buildings depends upon the color and finish of the interior walls and ceilings. This is especially important where indirect and semi-indirect lighting is employed, since these fixtures rely on the ceiling and walls for reflection and diffusion.

Store Lighting

Store lighting differs vastly from both industrial and office systems because of the decorative and selling features involved. Most store lighting consists of a combination of general, localized-general and supplementary lighting. High-intensity general lighting is sometimes sufficient for small stores, where elaborate display cabinets and niches are not used.

Stores depend on light for their sales, hence various lighting combinations are often installed—

General Lighting is used to illuminate the entire selling area to produce pleasant surroundings for both the customer and employee. The fixtures commonly used for this type of illumination include:

1. Various designs of indirect units both incandescent and fluorescent.
2. Various designs of direct units both incandescent and fluorescent.
3. Different designs of semi-indirect units both incandescent and fluorescent.

Decorative Lighting in the store is often used to enhance the display of merchandise and to accentuate the architectural design of the store interior. For this purpose some of the following units are employed:

1. Recessed colored panel lighting with either incandescent or fluorescent lamps.
2. Cove lighting with incandescent or fluorescent units, producing various color effects.
3. Indirect wall bracket units.

Localized-General Lighting in the store is accomplished by using a concentration of direct down lighting units over the immediate sales counter or table. Its purpose is to attract the customer to that particular sales area and make it easy to examine and choose the merchandise. It is an invaluable aid to the sales person as well as the customer. This type of illumination is often produced by:

1. Recessed down lights with or without louvers.
2. Recessed direct prismatic glass enclosed units.

Supplementary Lighting is used in the store to accentuate a particular display of merchandise. This type of illumination is used primarily to attract customer attention and produce what is known as "impulse buying." White, colored or daylight lamps are used depending upon the type of article displayed. The following units are often used for this type of spot lighting:

1. Spotlights, floor, wall or ceiling mounted with or without louvers.
2. Reflector and projector lamps which can be easily inserted with an appropriate adapter into present lighting outlets.

Display Cabinet Lighting is accomplished in various ways. Continuous trough incandescent or fluorescent units are recessed in the top, sides and bottom of display cabinets and showcases. Mirrored effects are sometimes used. There are numerous methods of lighting display cases and the choice depends upon the case design and the merchandise.

The Careful Approach

Lighting of industrial and commercial areas is not as difficult as it seems. It's a matter of a few simple "musts."

The contractor must study the customer's problem taking into account the purpose of the lighting, the physical characteristics of the area to be lighted, and the illumination intensity necessary and desired. He must be familiar with the lighting systems available and the various types of fixtures that can be used for each system. After studying the problem, he must be able to select the right system.

Once the contractor has grasped these basic fundamentals the rest is comparatively easy. But to give a clearer picture of the modern application of the various lighting systems in industry and commercial enterprises, the succeeding pages present case studies of actual installations engineered on the basis of the customer's individual problem. These case studies provide technical data for each installation from the viewpoint of the problem, the essential construction data, the choice of unit to solve the problem and the results attained. And by the combination of different practices shown here, modern lighting can be selected for the various conditions found in industrial or commercial buildings.

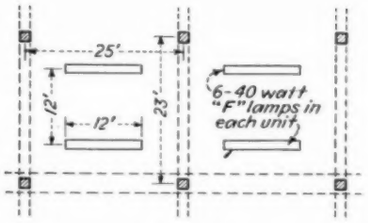
The purpose is purely suggestive, however. These are not all the good ways to install electric light. They are not necessarily the best. But they suggest a wide variety of treatments that may be adopted or adapted as desired.

COMMERCIAL GENERAL LIGHTING *in this store is provided by totally indirect incandescent units*

CEILING MOUNTED *side louvered fluorescent lighting luminaires provide 25 to 32 foot-candles in this department store*

Lighting a DEPARTMENT STORE

Fluorescent



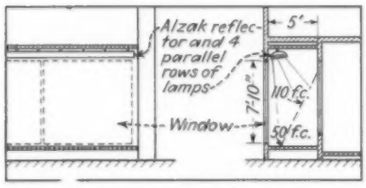
PLAN DETAIL *of the lighting layout shows spacing and arrangement of the units.*

PROBLEM—To provide general lighting of adequate intensity and proper quality for merchandising a wide variety of goods in a department store.

CONSTRUCTION DATA—The store occupies three floors, each floor divided into column bays averaging 23- by 25-ft. The ceiling height is 7-ft. 6-in. Upper walls and ceiling are finished in a light color.

SOLUTION OF PROBLEM—In each bay, two fluorescent luminaires are installed. Each unit is 12-ft. long with two rows of lamps. The lighting equipment is designed so that direct view of the lamp from the side at normal angles is blocked by louvers. A total of 484 units are installed throughout the entire store.

RESULTS—The average intensity on the first floor is 25 to 32 foot-candles, 20 to 25 on the second and 18 to 20 on the third. Average load density is 1.19 watts per sq. ft.



SECTIONAL VIEW *showing the arrangement of the fluorescent window reflectors.*

Lighting a SHOW WINDOW

Fluorescent

PROBLEM—To provide well diffused illumination of adequate intensity and quality for effectively displaying women's apparel in a show window.

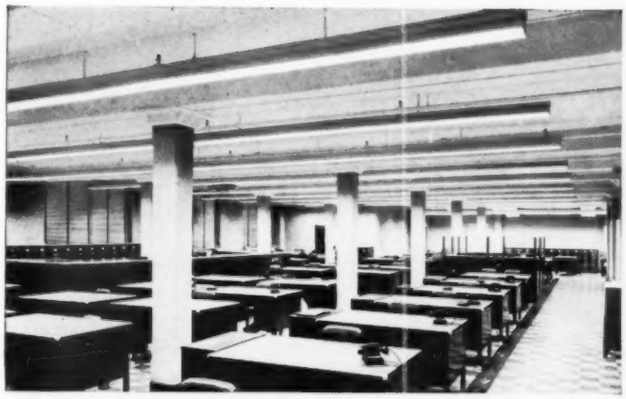
CONSTRUCTION DATA—The show window is 5-ft. in depth and the glass is 7-ft. 10-in. high with a narrow valance along the top. The two sections illustrated are 5-ft. and 16-ft. long.

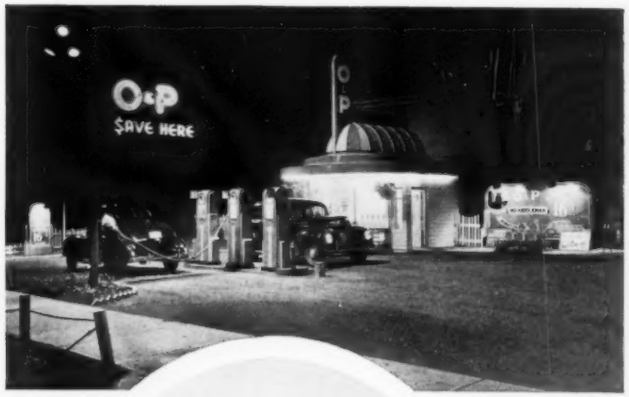
SOLUTION OF PROBLEM—Continuous fluorescent window lighting units are installed 4-in. above the top of the glass close to the front and running the full length of the window. Each of the end to end units contain four rows of 48-in. 40-watt fluorescent lamps. The fixtures are designed to concentrate the light within the narrow window area.

RESULTS—Foot-candle intensity ranges from 50 foot-candles on the floor at the front of the window to 110 foot-candles in the center of the display area.

FOUR DEEP *fluorescent continuous window lighting units provide 50 to 110 foot-candles in this department store window.*

NO ONE REFLECTOR CAN BE A *"Jack of all trades"*





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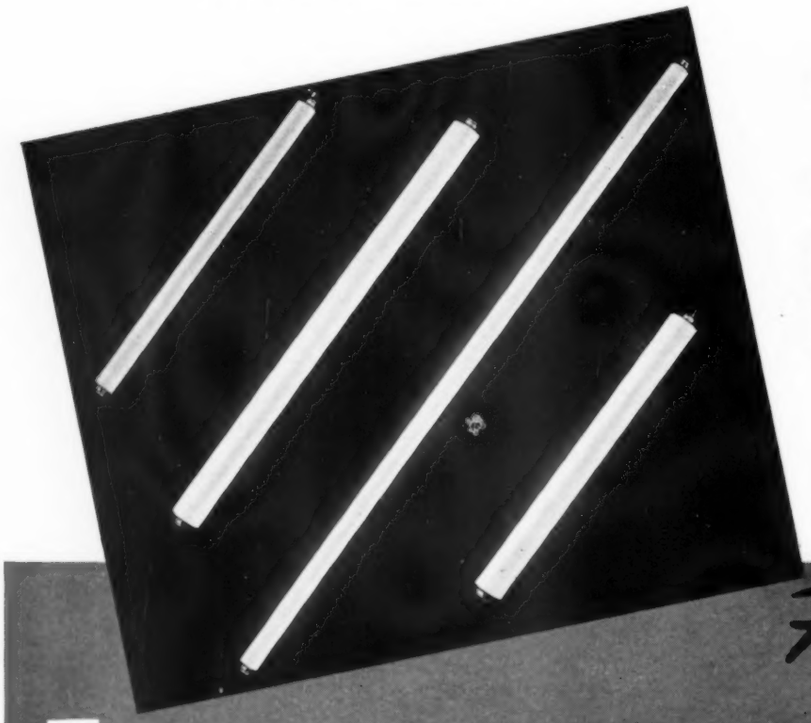

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FOR COMMERCIAL USE—MIRALUME HF-201: 200-watt unit; 4 40-watt tubes; approximate length, 50".

INDUSTRIAL MIRALUME F-100: 100-watts; 2 40-watt tubes; approx. length, 54". No nuts or bolts in reflector surface.

COMMERCIAL OR INDUSTRIAL—HF-200 MIRALUME: 200 watts; 4 40-watt tubes; approx. length, 50".

COMMERCIAL MIRALUME C-100: 2 40-watt tubes: approximate length, 49".

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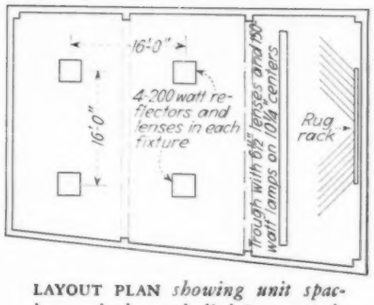
Copr. 1940 Hygrade Sylvania Corp.

LENSED INCANDESCENT *luminaires applied to a rug display.*

Lighting a RUG SALESROOM

Incandescent



LAYOUT PLAN *showing unit spacing and the rack lighting trough.*

PROBLEM—To provide adequate and attractive illumination with suitable quality and directional characteristics to display rugs.

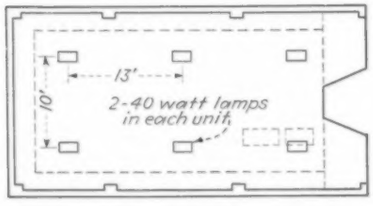
CONSTRUCTION DATA—The display room is 47- by 33-ft. in area, 17-ft. 4-in. high, divided into three bays lengthwise. Two bays are devoted to customer space and the display of smaller rugs. The third bay contains a 12-ft. vertical rack to display 9 by 12 rugs.

SOLUTION OF PROBLEM—The rug display rack was lighted by a continuous trough containing 150 watt lamps in a specular Alzak reflector with 6½-in. lenses on 10¼-in. centers. The sales area is illuminated by four luminaires, each fitted with four 12-in. lenses and sloping side panels of flashed opal glass. Behind each lens is a 200-watt lamp and a specular Alzak reflector.

RESULTS—On the display rack foot-candle intensities average 50 foot candles.

Lighting a SMALL STORE

Fluorescent



LAYOUT PLAN *shows the arrangement and spacing of the general lighting units.*

PROBLEM—To provide adequate and attractive illumination for sales and display in a shoe store.

CONSTRUCTION DATA—The area, including window, measures approximately 20 by 40-feet and is surrounded on three sides by conventional shelving for shoe boxes. The wiring is concealed in the ceiling. Upper walls and ceiling are painted with a light, highly reflecting finish.

SOLUTION OF PROBLEM—Six twin-lamp, direct fluorescent units are installed in the store. The units are suspended at a height of 10-feet above the floor and spaced on 10- by 13-feet centers. Each unit is equipped with two 40 watt white fluorescent lamps.

RESULTS—Evenly distributed lighting delivers 30-35 foot-candles at counter level, 15-20 foot-candles at the floor.

TWIN LAMP *fluorescent luminaires deliver 30 foot-candles at counter levels.*

Make Sure of Fluorescent Lamp Performance

←TO LINE (GRD.)
CONNECT OTHER SIDE OF LINE TO OTHER TERMINAL OF NO. 2 SOCKET.
TO NO.1 SOCKET→
←TO NO.2 SOCKET
JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS
TO NO.1 SOCKET→

with JEFFERSON E. T. L. Certified BALLASTS

● In step with the fast pace set by lamp makers—Jefferson engineers have provided the quality in Ballast design and construction necessary for long satisfactory lamp service.

● This quality is a result of a quarter-of-a-century of experience in the making of transformers, chokes and controls as used with luminous tubing, mercury lamps, X-ray lamps and street lamps. Jefferson research and engineering work together with expert manufacturing craftsmanship, insure uniformity of quality always.

● The Jefferson line of Ballasts include both single- and two-lamp types. To make the most of your fluorescent lamp installations—specify Jefferson Ballasts.

For Complete Data, write for Catalog No. 402-FL.

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To insure the maximum life and performance of fluorescent lamps, the manufacturers of the lamps have given the Electrical Testing Laboratories of New York, rigid specifications for fluorescent lamp Ballasts.

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●

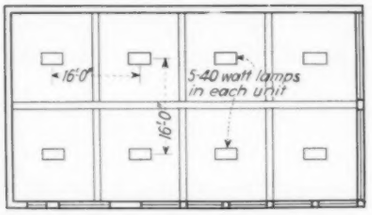
Listed as Standard by Underwriters' Laboratories, Inc.

All Jefferson fluorescent lamp ballasts and manual type switches are listed by Underwriters' Laboratories, Inc. and carry the Underwriters' label.

SUSPENDED DIRECT *fluorescent luminaires in an automobile show room.*

Lighting an AUTOMOBILE SHOW ROOM

Fluorescent



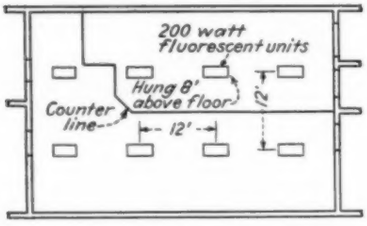
LIGHTING LAYOUT *centered fixtures in ceiling beam pattern.*

PROBLEM—To provide increased light intensity and improve the light quality to get a more attractive display of new automobiles.

CONSTRUCTION DATA—The display room is 64-ft. long and 36-ft. wide with offices at the rear and continuous show window along the front and left hand side. Wiring is concealed in the ceiling and outlets come in the center of each of eight ceiling bays.

SOLUTION OF PROBLEM—General illumination is provided by eight 200-watt fluorescent lighting units arranged in two rows of four units each. The spacing is 16-ft. center to center and the mounting height 11-ft. above the floor. Each unit contains five parallel 40 watt fluorescent lamps mounted with the lamps parallel to the longer room dimension.

RESULTS—Average intensity on a plane 30 inches above the floor is 15 to 18 foot-candles. The general lighting load is 78 watts per sq. ft. including loss in ballast equipment.



LAYOUT PLAN *giving arrangement and spacing of the fluorescent lighting units.*

Lighting a SMALL BANK

Fluorescent

SUSPENDED FLUORESCENT *luminaires deliver 25 foot-candles in this small bank.*

PROBLEM—To provide cool light of adequate intensity and proper quality for the visual tasks involved in a small bank.

CONSTRUCTION DATA—The room is 48-ft. long and 32-ft. wide with private offices at front and at the rear. The finish of the walls and ceiling is light. A banking counter partition divides the space approximately in half.

SOLUTION OF PROBLEM—General illumination is provided by eight 200-watt fluorescent lighting units mounted in two rows on 12-ft. centers eight feet above the floor. Suspended luminaires with diffusing glass provide direct light of low brightness and a portion of the light is directed up to the ceiling.

RESULTS—Average intensity at 30-in. above the floor is 25 foot-candles after 1200 burning hours. General lighting load is 1.1 watts per sq. ft. including loss in auxiliaries.

The illustration above shows the solution of a difficult but common problem: modern efficient lighting for the office with mill-type ceiling. Great care was exercised in the selection of lighting equipment for this modern office. Efficiency, low maintenance cost and appearance were all factors in selling SkyLux for this installation. The result in spite of unfavorable structural conditions is, as the photograph shows, a well lighted, pleasant, and business-like room.

When suspended in long, even rows, SkyLux directs the attention away from high ceilings and exposed beams. For another type of room, with low ceiling, SkyLux would be mounted directly on the ceiling surface.

SkyLux will help you sell the big jobs, substantial jobs, those with profit in them for you and satisfaction with lighting economy for your customers. Write for our complete SkyLux catalog, Serial 1050.

TWIN SKYLUX

1. FLURACITE REFLECTOR
2. LAMP SHIELD
3. FLUORESCENT LAMP (Not supplied)

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Curtis Lighting

NEW YORK — 1123 West Jackson Blvd. CHICAGO — TORONTO

YOU CAN EXPECT *Fluorescent Lighting at its Finest* WHEN YOU SPECIFY BENJAMIN

YOU CAN EXPECT LIGHT to play an even more important part in improving employee efficiency, increasing accuracy of inspection operations, reducing fatigue and minimizing accidents when you install Benjamin Fluorescent Lighting. Because Benjamin Fluorescent Lighting makes it practical both from the standpoint of *cost* and *seeing* to use MORE LIGHT in plants, offices and other commercial locations.

You not only get this EXTRA LIGHT economically but you get a new kind of light which permits the use of MORE LIGHT without excessive brightness or annoying glare—a light that promotes the speed and increases the ease of seeing.

You Get a COLD LIGHT (75% less radiant heat) that enables you to mount lighting units close to the work area . . . that makes it ideal for air conditioned locations.

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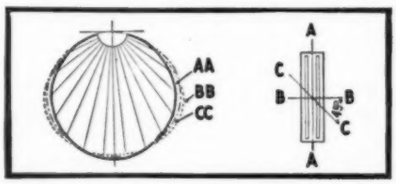
YOU CAN EXPECT Fluorescent Lighting Units that are Designed Right



Every Benjamin Fluorescent Lighting Unit is certified by Benjamin to embody the most approved principles of lighting reflector design . . . to provide the highest light output commensurate with seeing ease . . . to provide adequate light cut-offs for minimizing glare . . . and to embody the Benjamin design principles developed through years of leadership in industrial and utilitarian lighting.

YOU CAN EXPECT Low Operating Costs, Low Maintenance Costs and Long Life . . .

Every Benjamin Fluorescent Lighting Unit is built to the nationally known Benjamin standards for quality and durability. They incorporate many exclusive features of design and construction which reduce operating and maintenance costs and and insure longer life. They are certified by Benjamin to conform with all of the requirements of the Underwriters' Laboratories, and to comply with highest safety requirements, illumination, electrical and mechanical standards. They are easy to install . . . include special provisions for quick, easy relamping and servicing, and special devices to protect the life of lamps and circuits.

BENJAMIN ELECTRIC MFG. CO.
Dept. H, Des Plaines, Illinois

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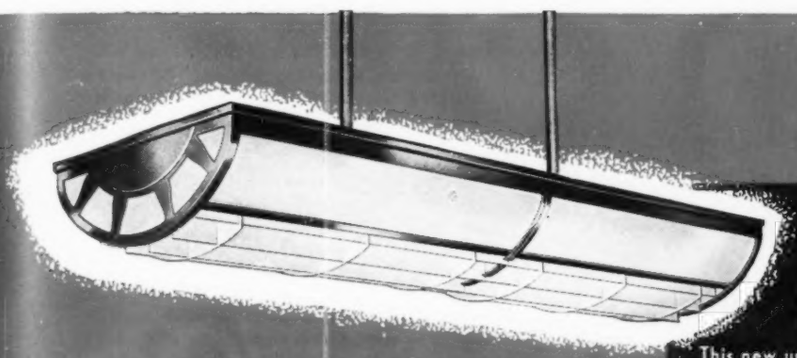
FLUORESCENT UNITS

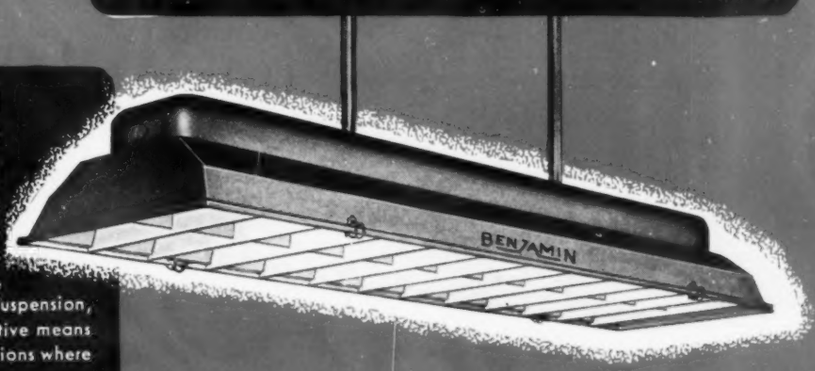


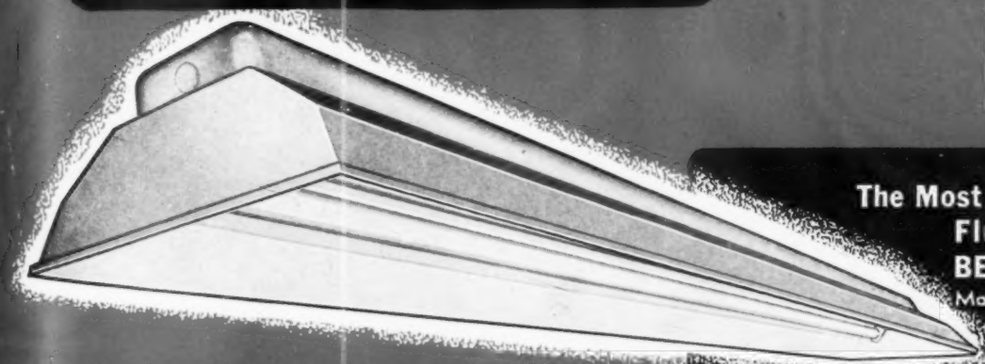
NOW! A BENJAMIN Engineered Fluorescent Lighting Unit for Store, Office and Other Commercial Use. The New Benjamin FLUR-O-LITE

This new unit marks a new advance in Fluorescent Lighting for commercial use. Outstanding features include: RIBBED GLASS PANELS which directs rays outward increasing the spread of light upon ceiling; DIFFUSING PLASTIC PANELS, which cut down lamp brightness; GREATER ACCESSIBILITY, EXCEPTIONAL EFFICIENCY, OUTSTANDING BEAUTY OF DESIGN. *Send coupon for data bulletin.*

BENJAMIN RLM STREAM-LITER WITH NEW BENJAMIN LOUVERS AND TWIN STEM CANOPY SUSPENSION

These new louvers improve appearance and provide additional shielding so that lamps are hidden at most angles of vision. They increase shielding angles to 23 degrees on all sides of the reflector, yet due to their careful design, light loss by interference is minimized. The new Canopy Suspension, illustrated with this unit, provides an efficient and attractive means of suspending Benjamin Stream-Liters in offices and locations where improved appearance is desirable.





The Most Widely Used of All Industrial Fluorescent Units . . . THE BENJAMIN RLM STREAM-LITER

Made of Benjamin Lifetime porcelain enamel, the Stream-Liter is designed for general illumination with 48", 40-watt lamps and features 78% light output efficiency, 72½ degree cut-off angle and closed end lamp shielding. Equipped with renewable lamp starters and high power factor auxiliaries which minimize flicker. Carries RLM Label indicating conformance to RLM Specifications.

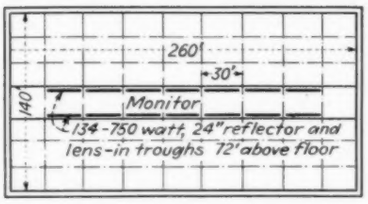
AVAILABLE SOON! NEW BENJAMIN UNIT FOR NEW 60" FLUORESCENT LAMPS

This new Benjamin unit utilizing the new 60" Fluorescent lamps will provide even higher levels of Fluorescent Lighting. Data Bulletin ready soon. Write Now.

GENERAL LIGHTING *is projected from 750-watt reflectors and lenses on the girders.*

Lighting an ARMORY

Incandescent



CONCENTRATING LIGHTING *units under monitor are accessible from catwalk.*

PROBLEM—To provide evenly distributed, glare-free and shadowless illumination over a large, unbroken area, with equipment engineered and installed for accessible servicing.

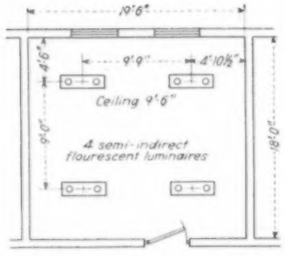
CONSTRUCTION DATA—The floor area is 260-ft. by 140-ft. The roof is supported without columns by ceiling girders. A catwalk provided access to windows in a monitor down the center.

SOLUTION OF THE PROBLEM—Two rows of troughs, 14 sections in all, are mounted along the center of the ceiling accessible from the window catwalk. A total of 124—24-in. lensed reflectors with 750-watt lamps, correctly designed and focused to distribute the light evenly over the entire floor area, are used. In some cases the light beam is off-set to eliminate any possibility of shadows being cast by the ceiling girders.

RESULTS—Readings taken at the floor six months after installation averaged 25 foot-candles.

Lighting an EXECUTIVE OFFICE

Fluorescent



LAYOUT PLAN *showing the arrangement and spacing of luminaires*

FLUORESCENT LUMINAIRES *provide 28 foot-candles of cool light in this executive office.*

PROBLEM—To provide high quality illumination in an office without annoying heat dissipation from lighting.

CONSTRUCTION DATA—Office is 18-ft. by 19-ft. 6-in. and has a 9-ft. 6-in. ceiling. Walls are buff and ceiling is acoustically treated with cork blocks finished white to give a reflection factor of 80 per cent.

SOLUTION OF PROBLEM—Four fluorescent semi-indirect luminaires are installed on a 9-ft. by 9-ft. spacing. Each unit is equipped with four 40-watt white fluorescent lamps. Hinged bottom is a ribbed diffusing glass. Side panels are diffusing glass. Overall length of unit is 24 inches.

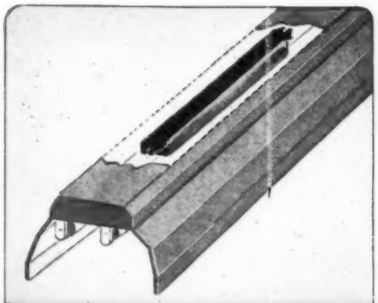
RESULTS—High quality, well diffused, "cool" lighting is provided. Average illumination is 28 foot-candles.

Streamlined... W2-43

CERTIFIED UL E·T·L SPEC NO 6 HIGH P.F.

...the new SOLA 2-LAMP BALLAST

FOR TWO 40-WATT FLUORESCENT LAMPS!



COMPACT — NEAT — All unwieldly bulk eliminated . . . a neat, compact unit that fits comfortably into the restricted wiring channels of modern streamlined lighting fixtures.

W2-43 . . . a streamlined two-lamp ballast with integral starting compensator that retains in full the efficiency heretofore available only in ballasts of unwieldly dimensions.

1. **Only** 1⅝ inches high by 2⅝₃₂ inches wide.
2. **Reduces Space Requirement** . . . fits comfortably and compactly into the restricted area of wiring channels.
3. **Easy Installation** . . . single unit simplifies fixture assembly.
4. **Certified Performance** . . . exceptionally quiet . . . exceptionally dependable.
5. **Fully Guaranteed** against defective materials or workmanship.
6. **Laboratory Tested** under actual lamp operating conditions.
7. **Prompt Deliveries** assured on every order.

SOLA ELECTRIC CO.

2525 CLYBOURN AVE., CHICAGO

SOLA ELECTRIC COMPANY
2525 Clybourn Ave., Chicago, Ill.

Please send Fluorescent Ballast Specifications.

Also bulletins on the following:— Bulletin-JFL-57

- ☐ Transformers for Mercury Lamp lighting.
- ☐ Transformers for Luminous Tube Signs.
- ☐ Transformers for Power, Signals and Controls.
- ☐ Constant Voltage Transformers.

Name.....

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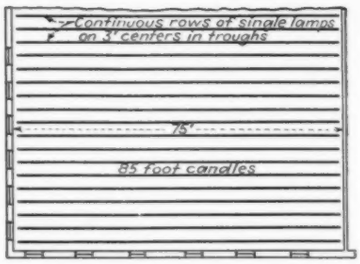
City.....State.....

HIGH INTENSITY *fluorescent trough installation provides 85 foot-candles at table height.*



PARTIAL PLAN *showing the layout and spacing of the fluorescent troffers.*

Lighting an OFFICE

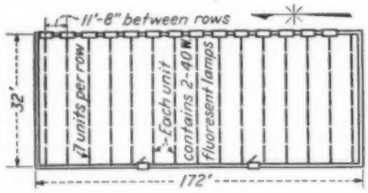
Fluorescent

PROBLEM—To provide high quality lighting and high illumination intensities in an engineering department office.

CONSTRUCTION DATA—The office covers an area of 11,900 sq. ft. with a 14½-ft. ceiling. The ceiling and side walls are finished in a light color.

SOLUTION OF PROBLEM—Fluorescent troffers are installed in the ceiling, running the width of the area and spaced three feet apart. The deep troughs are open at the bottom and contain a continuous row of 40-watt daylight fluorescent lamps.

RESULTS—Lighting intensities at desk level average 85 foot-candles.



LAYOUT DIAGRAM *of the suspended fluorescent lighting units.*

Lighting a FILE OFFICE

Fluorescent

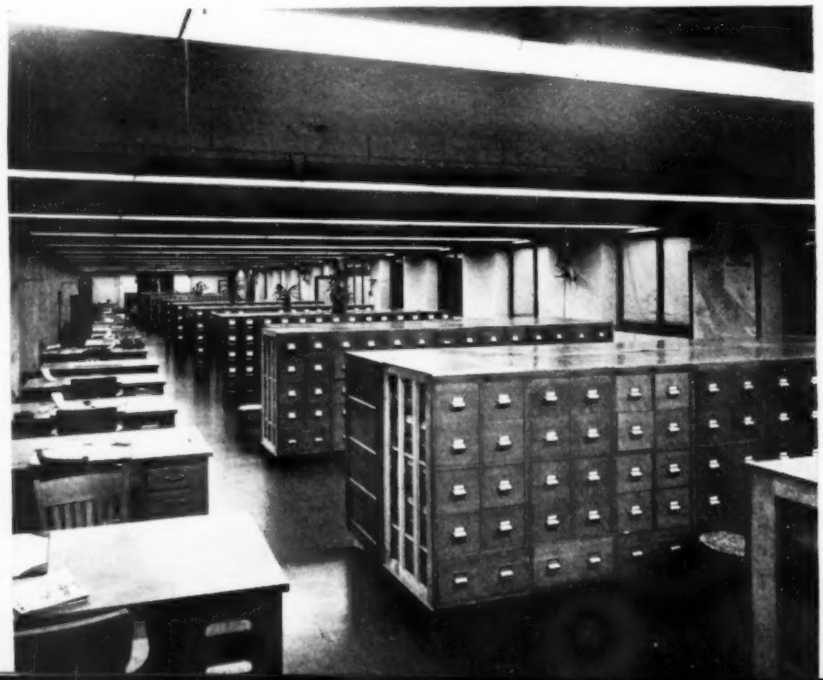
PROBLEM—To provide high intensity illumination in the file office of a Criminal Identification Bureau, to speed the work of selecting finger print records.

CONSTRUCTION DATA—The room is 32-ft. wide by 172-ft. long and 10-ft. 6-in. high. Groups of filing cases back to back extend more than halfway across the room. Along the opposite wall a row of desks are lined up.

SOLUTION OF PROBLEM—Fifteen rows of seven RLM fluorescent luminaires per row are installed. The rows are spaced 11-ft. 8-in. apart with close end to end spacing of the units. A channel supporting member hung from the old outlets carries the units and encloses the wiring.

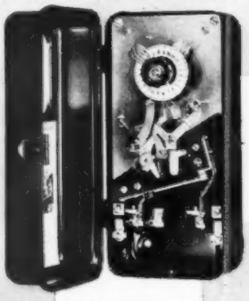
RESULTS—Illumination of 75 foot-candles is obtained at the top of the filing cabinet and 35 foot-candles at the lower drawer. At a distance of 42 inches above the floor 45 foot-candles is obtained.

CRIMINAL IDENTIFICATION *files are lighted with 75 foot-candles at top of cabinet.*



IS THIS FEATURE ON THE TIME-SWITCH YOU NOW BUY?

***the opportunity of choosing from* A COMPLETE LINE...**



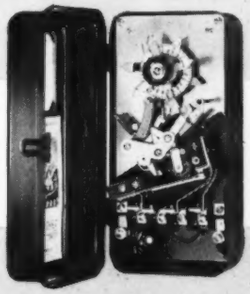
Form KA for applications where no variations are required from a regular daily sequence.

Form KAZ. The astronomic dial changes automatically "on" and "off" operations in accordance with suntime.

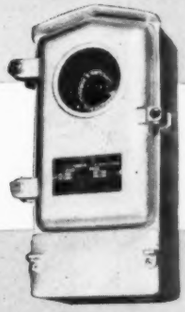
Form VSW provides an automatic carry-over, assuring continuous operation during current interruptions.

Form VSWZ operates the same as Form VSW with the added advantage of an automatic astronomic dial.

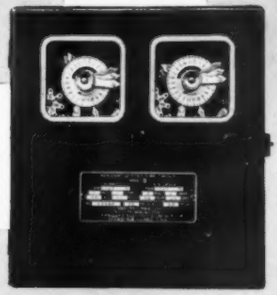
Form VW is an electrically wound time-switch for A.C. operation, available in a wide variety of combinations.



Form KAY is a two-circuit time-switch in which the "on" and "off" circuits of each are independent.



Form KAHO. A completely weather-proof time-switch available in all ratings.

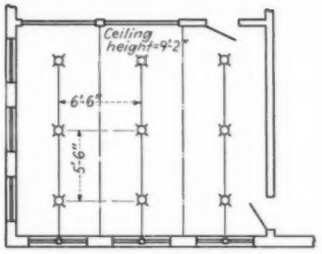


Form KAHD duplex. Two separate switch units are operated by the same timing mechanism.

....FOR EVERY PRACTICAL APPLICATION

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

INDIRECT UNITS *reflecting from Parabolume ceiling provide 55 foot-candles.*



LAYOUT *of lighting units. Parabolume is between beams.*

Lighting a FACTORY OFFICE

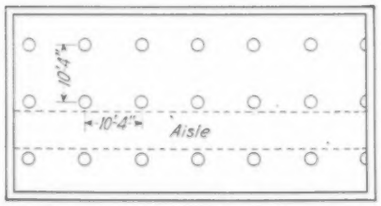
Incandescent

PROBLEM—To provide high intensity glareless illumination in a factory office.

CONSTRUCTION DATA—The office consists of a metal and glass partitioned area 20- by 17-feet. Ceiling is 9-ft-2-in. high with beams dividing the area into three bays.

SOLUTION OF PROBLEM—Full indirect incandescent luminaires with 500-watt silver bowl lamps are installed in the center of the bays on 5-ft. 6-in. by 6-ft. 6-in. centers. Over the ceiling area above the units Parabolume reflector sections are installed.

RESULTS—The six units provide 55 foot-candles in the office with a load density of approximately 9-watts per square foot.



PLAN VIEW *showing the arrangement and spacing of the coffer fixtures.*

Lighting a DRAFTING ROOM

Incandescent

INCANDESCENT COFFER *units provide high-intensity illumination on the drawing tables in this eastern ship building plant*

PROBLEM—To provide satisfactory, high-intensity, evenly distributed illumination in a large drafting room containing 610 drawing tables.

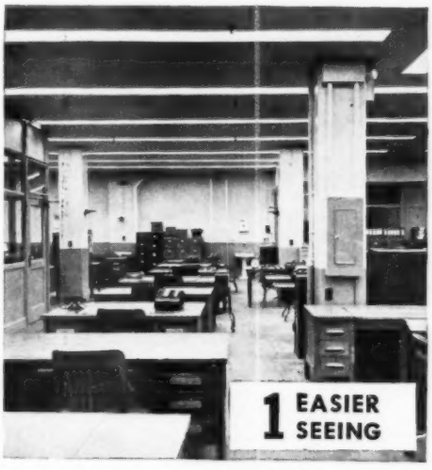
CONSTRUCTION DATA—This large drafting room has an 11-foot ceiling height and no skylights or other means of providing sufficient natural illumination for the visual tasks of the 610 men working on the tables. Ceiling and walls are finished with a light color paint.

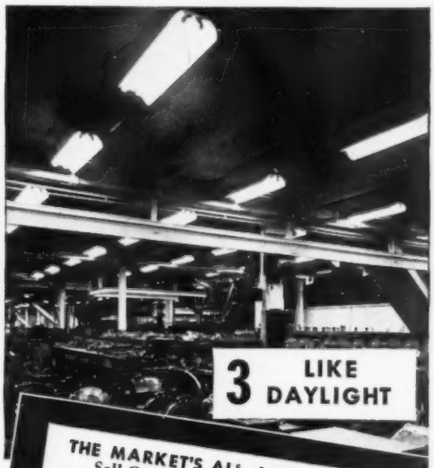
SOLUTION OF PROBLEM—High-intensity general lighting is produced by 286 incandescent coffer units each using a 500-watt silvered bowl lamp. The units are mounted flush with the ceiling 11 feet above the floor and are spaced on 10-ft. 4-in. centers. Radiant heat from this large number of lamps is no problem because the room is air-conditioned.

RESULTS—The average illumination intensity on the working plane at the tables is 63 foot-candles.

New, greater selling opportunities with fluorescent indoor daylight in

Certified★ FLEUR-O-LIERS





Intensive National Advertising Pre-Sells Your Customers!

Here's one of the most remarkable selling advantages electrical contractors have had in years!

Powerful national advertising, in Saturday Evening Post, Time, Newsweek and 15 trade and business publications has been telling your customers about the new advantages of Certified★ FLEUR-O-LIERS . . . helping you to uncover bigger and better markets.

Advertising this month and for the balance of the year tells the FLEUR-O-LIER story to store managers and executives, factory managers, building managers . . . a wide range of industrial and commercial prospects.

Sell fluorescent indoor daylight at its best . . . in Certified★ FLEUR-O-LIER fixtures—made by 35 leading fixture manufacturers . . . *Certified★* by Electrical Testing Laboratories.

Write today for a list of manufacturers and the new FLEUR-O-LIER fact book, which gives complete information on types of units now available. FLEUR-O-LIER MANUFACTURERS, 2122 Keith Building, Cleveland, Ohio.

THE MARKET'S ALL AROUND YOU!
Sell Certified★ FLEUR-O-LIERS to
Stores Offices Hotels Hospitals
Factories Restaurants Display Rooms
Pictured here are some of the units now available.

FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.
A Copy of This Certificate Should
ETL
Appear upon Each Unit or Package
FLUORESCENT LIGHTING FIXTURES EMPLOYING RAPID START TYPE OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES, AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

Look for this label . . . Electrical Testing Laboratories certify that FLEUR-O-LIERS have met with over 50 rigid specifications for good light—good service, as set up by MAZDA lamp manufacturers. All Certified★ FLEUR-O-LIERS must be equipped with auxiliaries (ballasts and starters) certified by E. T. L.

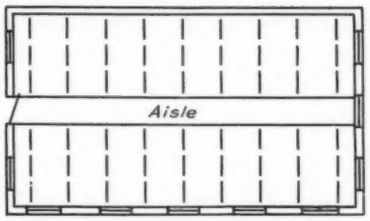
FLEUR-O-LIER *Manufacturers*

Whenever you buy fluorescent lighting . . . Insist on CERTIFIED FLEUR-O-LIERS

FLUORESCENT LIGHTING *of drafting room in a manufacturing plant.*

Lighting a DRAFTING ROOM

Fluorescent



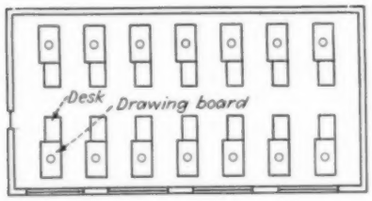
PLAN VIEW *of drafting room showing the grouping and spacing of the units.*

PROBLEM — To provide adequate and cool illumination of proper quality for easy performance of visual tasks involved in drafting work.

CONSTRUCTION DATA — The room is 65 feet long and 36 feet wide, with a central aisle. Offices are at front end and reference tables along the back wall. Wiring is concealed in ceiling.

SOLUTION OF PROBLEM—General illumination is provided by 54 RLM type two lamp fluorescent units arranged in two groups. Each group has nine rows of three units each, mounted on 6-ft. by 7-ft. 3-in. centers, 8-ft. 3-in. above the floor. Units have two 40-watt daylight lamps each and are chain suspended. Each row of three units is fed from one outlet and wired end to end.

RESULTS — Average intensity on the boards is 50 to 60 foot-candles. Net lamp load, 1.84 watts per sq. ft.; with ballast, 2.02.



PLAN VIEW *showing drafting table supplementary lighting unit arrangement.*

Lighting a DRAFTING ROOM

Incandescent

PROBLEM—To provide adequate illumination of proper quality for easy performance of the critical visual tasks involved in drafting work.

CONSTRUCTION DATA—One side of the room has large windows for natural illumination. The ceiling is approximately 10 feet high and is constructed of sound proof material. There are two rows of seven tables each and a center aisle. Each table has a desk beside it. General illumination is provided.

SOLUTION OF PROBLEM—Supplementary illumination is provided by 14 direct incandescent skylight type units, using two 150 or 200 watt lamps and daylight glass covers over the units. One unit is mounted above the center of each table at a distance of 4-ft. 4-in. from the working plane. Each unit is controlled by a separate ceiling pull switch.

RESULTS—Units with the 150 watt lamps give an illumination intensity of 26 foot-candles on the working plane; those with the 200 watt lamps give 35 foot-candles.

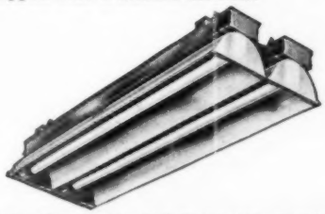
SUPPLEMENTARY INCANDESCENT *lighting over individual tables in drafting room of a manufacturing plant.*

WIREMOLD has Plenty good "dope"!

LINE-O-LAMPS

INDUSTRIAL FLUORESCENT LIGHTING

Available with or without concentrating or distributing type Alzak reflectors. Wired or unwired for any size or number of lamps. Wired units equipped with Wiremold Controls.



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Low cost, high efficiency multiple units for industrial use, show windows, etc. For 18", 24", 36", 48" lamps, with distributing or concentrating Alzak reflectors and Wiremold Controls.

"PLUGMOLD"

Multi-Outlet Assembly

For homes, offices, stores, display rooms and industrial buildings. Permits location of outlets exactly where needed. Also permits relocation with minimum effort and expense. Two sizes: — No. 2100 with capacity 6 No. 12 wires; No. 1900 with capacity 2 No. 14's.

"PANCAKE"

OVERFLOOR WIRING SYSTEMS

Strong, flat raceway section that is trip-proof on floors for office and factory use. Available with complete line of fittings for light, telephone or limited power.

Four sizes of raceways with complete series of fittings. Providing an economical and efficient method for wiring of commercial, industrial and public buildings, where extension to or relocation of wiring is desirable over a period of years. Easily installed on the surface for re-wiring of old buildings.

★ WIREMOLD ENGINEERING DATA SHEET SERVICE ★
★ WIREMOLD ENGINEERING DATA SHEET SERVICE ★
DR. NO. ES. 157
FLUORESCENT LAMP INSTALLATION FOR
FACTORY ASSEMBLY OR INSPECTION ROOM

TO HELP ALERT CONTRACTORS *2uickly* MEET NATIONAL DEFENSE NEEDS . . .

- *for* WORK-SPEEDING FLUORESCENT "DAYLIGHT"
- *for* FASTER, LESS COSTLY REWIRING of OLD BUILDINGS
- *for* TIME-SAVING, PRODUCTION-SPEEDING IDEAS IN INDUSTRIAL WIRING

Wiremold Raceway and Fittings are listed by Underwriters Laboratories, Factory Mutual Laboratories and Canadian Engineering Standards Association.

Your Business Builder

THE WIREMOLD, CO., HARTFORD, CONN.

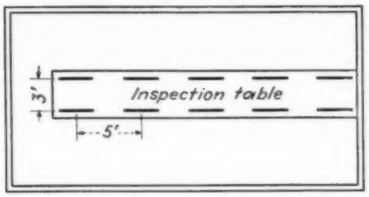
ADEQUATE WIRING SERVES AND SAVES

WIREMOLD

LIGHTING and WIRING EQUIPMENT

LISTED BY UNDERWRITERS' LABORATORIES, INC.

PARTS ASSEMBLY *in this manufacturing plant is made easy by high intensity fluorescent localized lighting over the assembly table.*



PLAN VIEW *showing the location and spacing of the fluorescent fixtures.*

Lighting an ASSEMBLY TABLE

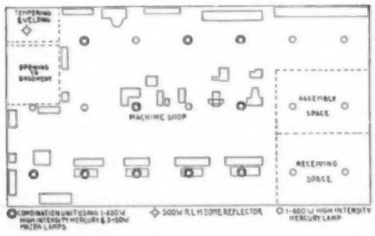
Fluorescent

PROBLEM—To provide adequate illumination of the proper quality to ease the visual tasks involved in the assembly of small parts.

CONSTRUCTION DATA—The room in which the assembly work is done is 60 feet long by 18 feet wide and contains an assembly table 42 feet long and 4 feet wide. General illumination is provided by six 200-watt RLM units.

SOLUTION OF PROBLEM—High intensity local lighting of the assembly table is provided by 16 single tube open type fluorescent reflectors installed in two rows of eight units each. The units contain 20-watt daylight fluorescent lamps and are spaced on 3-foot by 5-foot centers and mounted 30-inches above the table. Each ceiling conduit suspension, centered over the table, feeds two units through "T" and "LB" type conduit fittings.

RESULTS—An initial lighting intensity on the table tops of 60 foot-candles under the units and 45 foot-candles between the units.



PLAN VIEW *showing the location of the different types of lighting units.*

Lighting a MACHINE SHOP

Mercury – Incandescent

PROBLEM—To provide adequate and satisfactory illumination for the easy and accurate performance of visual tasks in a machine shop.

CONSTRUCTION DATA—The area occupied by the shop is 150 feet long by 60 feet wide. The clearance of the top of the traveling crane is 22 feet above the floor. Steel trusses support the roof. Both walls and ceiling are painted white.

SOLUTION OF PROBLEM—General illumination in the machine areas is provided by combination high-intensity mercury-incandescent lighting units to decrease stroboscopic effect of the mercury lamps on rotating parts. Straight high-intensity mercury units were used in the remaining floor areas. The combination units use one 400-watt type H-1 mercury lamp and three 150-watt clear incandescent lamps in an aluminum reflector with a diffusing glass globe. Straight mercury units use one 400-watt mercury lamp in a porcelain-enameled dome reflector with a diffusing glass collar around the lamp.

RESULTS—The average illumination on the working plane is 20 foot-candles.

MERCURY-INCANDESCENT *units are used with straight mercury fixtures for general lighting of this west coast machine shop.*

THERE IS NO TAX ON QUALITY

DONGAN

The Complete Line.

Controls for every application of
FLUORESCENT LIGHTING

The **NEW**

2-Lamp "long" types enter standard wiring channel . . . include starting compensator . . . are high power factor . . . minimize stroboscopic effect.

•

Dongan Controls are made in the same plant . . . by the same organization that has built up

"The Dongan Line Since 1909."

Dongan builds a complete line of dry transformers for all purposes. . .

- Bell Ringing . . . Chimes
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- Power Step-down
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- Neon Signs
- Oil & Gas Burner Ignition
- Transformers for Toys
- Custom built lines to suit special applications

And all of these lines are

"TOPS"

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DONGAN ELECTRIC MFG. CO.
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Please send me my free copy of "Jonnie"
Dongan tells all on POWER FACTOR

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Installation of heavy duty explosion-proof and watertight receptacles for floor and apron mounting. Capacities 30 and 60 ampere 3 and 4 pole. Floor covers are made of special heat treated semi-steel castings capable of withstanding tremendous loads and sudden shocks.

Installation of heavy duty angle type water-tight receptacles on field lighting transformer vaults. For complete listings of these receptacles see pages 49 to 59 of the new R & S catalog.
See also explosion-proof receptacles page 42.

AIRPORT LIGHTING AND WIRING

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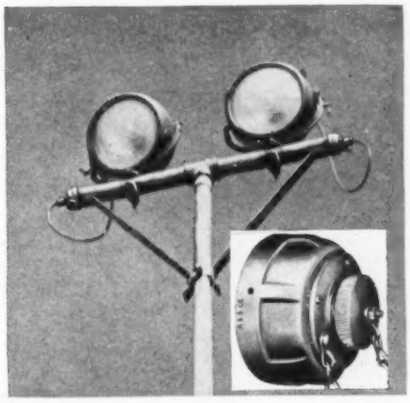
It is on your unusual installation jobs where you will appreciate the service available in the new R & S catalog.

Beyond the cataloging of equipment for lighting airports, yards and other exposed locations and for indoor hazardous locations—the 256 page book goes into data applying to them such as codes, analyses of inflammable liquids and gases, listing explosive dusts, ignitible fibres, combustible particles and linters. So when the problems of unusual installations come up—just reach for the answer in your R & S Catalog.



Russell & Stoll pipe-end mounting receptacles installed on a typical floodlight tower for the connection of removable floodlights. Such installations permit greater ease in the servicing and replacement of lights.

- *Lighting Fixtures*
  100 to 500 Watts
- *Switches*
  10 to 200 Ampere
- *Circuit Breakers*
  10 to 600 Ampere

RUSSELL & STOLL COMPANY

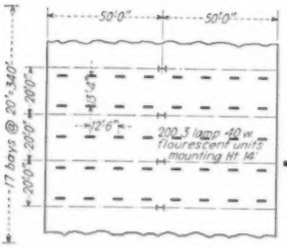
(AND SUBSIDIARY, FEEDRAIL CORPORATION)

150 Park Place **New York, N. Y.**

FLUORESCENT TROUGH *illumination of frame spinners in an eastern worsted mill.*

Lighting a FRAME SPINNING ROOM

Fluorescent



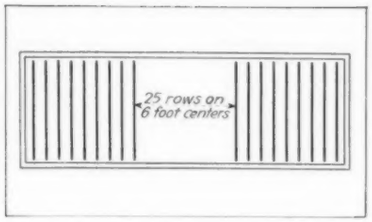
PLAN VIEW *of typical bays showing the grouping and spacing of the units.*

PROBLEM—To provide sufficient quantity and proper quality of illumination over the entire working area to facilitate better seeing and comfortable working conditions.

CONSTRUCTION DATA—The low bay area is 100 feet by 340 feet with a 14-foot truss height. The bays are 20 feet by 50 feet. Ceiling and trusses are finished with aluminum paint.

SOLUTION OF PROBLEM—General illumination is provided by 200 fluorescent luminaires, each with three 40-watt daylight fluorescent lamps, installed on 12-ft. 6-in. by 13-ft. 4-in. centers and mounted 14 feet above the floor. Each unit has three individual aluminum reflectors enclosed in a steel housing and has a power factor of 90–92 per cent. Units are suspended from the ceiling by detachable hangers and are supplied by a three-phase, four-wire, 120/208 volt system. Lamps are staggered on phases to eliminate flicker.

RESULTS—The average illumination is approximately 25 foot-candles, uniformly distributed. The color and quality of light closely resembles daylight.



PLAN VIEW *showing the spacing and arrangement of the continuous troughs.*

PROBLEM—To provide high-intensity, cool illumination for the operation of frame spinners.

CONSTRUCTION DATA—The frame spinners are set up in a room 50 feet wide and 152 feet long with an average ceiling height of 13 feet. Steel columns, girders and beams support wood floors and ceilings. A mule spinner and filler winder are also in operation in this area.

SOLUTION OF PROBLEM—The area is lighted by 25 continuous rows of fluorescent trough, mounted on six-foot centers. Each row consists of 12 four-foot trough sections, each section containing a 40-watt, white fluorescent lamp. Each row is suspended four feet from the ceiling by chains from the center of each four-foot section to a hook in the ceiling. Wiring circuits are fed in one end of the row.

RESULTS—Illumination intensities at the working plane of the machines is 37 foot-candles; at the top of the machines, 40 foot-candles; at each lower rail, 30 foot-candles.

Lighting for PRECISION MANUFACTURING

Fluorescent

LOW BAY FLUORESCENT *lighting in the manufacturing area of a graphite bronze plant.*

THIS MONTH'S ★ ★ ★ ★
4-STAR PERFORMANCE

PLACE: THE MISSES' DEPT.
THE MAY CO.
CLEVELAND, OHIO

FEATURING: **WATCO ENGINEERING**

Probably nowhere is ideal illumination more important than in a high quality dress department like this one, where fine fabrics, rich colors, and detailed workmanship are the real "stock in trade." Fixtures by WATCO, specialists in applying fluorescent light for maximum results, is your assurance of complete customer satisfaction.

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DISTINCTIVE FLUORESCENT FIXTURES FOR EVERY IMPORTANT INSTALLATION

WATCO gives you a full line of standardized fluorescent fixtures for every commercial, industrial, and residential requirement . . . all designed for maximum illuminating efficiency and pleasing appearance. In addition, WATCO places the services of its engineering staff at your free disposal for the solution of any installation problem requiring specially designed equipment. Make it a practice to consult WATCO on all your important lighting projects . . . our experience will help you *clinch* the order and assure greater ultimate customer satisfaction.

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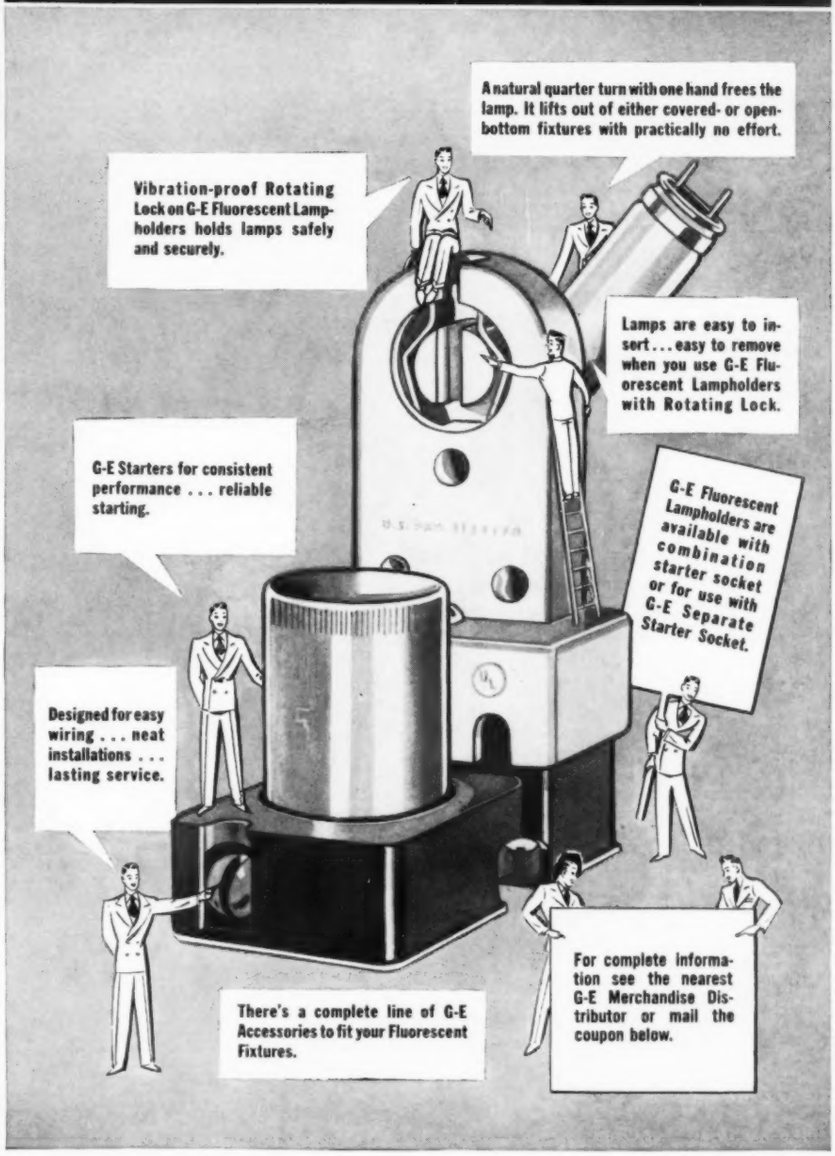
WATCO ENGINEERING, INC.
CLEVELAND, OHIO, U.S.A.

G-E FLUORESCENT LAMPHOLDERS AND STARTERS


A natural quarter turn with one hand frees the lamp. It lifts out of either covered- or open-bottom fixtures with practically no effort.
Vibration-proof Rotating Lock on G-E Fluorescent Lampholders holds lamps safely and securely.
Lamps are easy to insert . . . easy to remove when you use G-E Fluorescent Lampholders with Rotating Lock.
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G-E Fluorescent Lampholders are available with combination starter socket or for use with G-E Separate Starter Socket.
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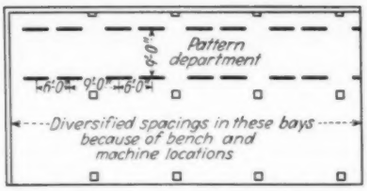
GENERAL ELECTRIC

CRITICAL SEEING *tasks in the pattern department of this eastern industrial plant are made easy by fluorescent lighting*

Lighting a PATTERN DEPARTMENT *Fluorescent*



PLAN VIEW *showing the location and spacing of the fluorescent fixtures.*

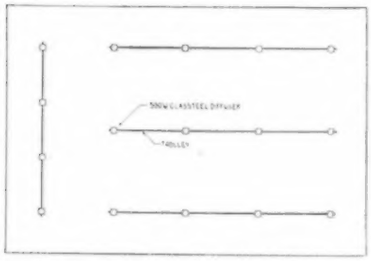
PROBLEM—To provide a diffused, high-intensity cool illumination for the critical visual tasks involved in pattern making.

CONSTRUCTION DATA—This department occupies a number of consecutive bays along one side of the room. There are two long rows of benches with a wide aisle between them. Columns, beams and ceiling are of steel reinforced concrete. Old lighting fixtures were dismantled but circuits remained intact.

SOLUTION OF PROBLEM—High-intensity illumination is provided by open type fluorescent reflectors, each using two 40-watt daylight fluorescent lamps. Units are chain suspended from the ceiling and mounted seven feet above the floor on six-foot by nine-foot spacings. One row of units is over each line of benches. Individual pull switches are an integral part of each unit which is connected to the circuit through a "B" conduit fitting.

RESULTS—The average illumination intensity at bench level is 75 foot-candles.

Lighting a MODEL SHOP *Incandescent*



PLAN VIEW *of the working area showing the duct runs and the units.*

PROBLEM—To provide adequate, properly distributed comfortable illumination for the variety of visual tasks in model making.

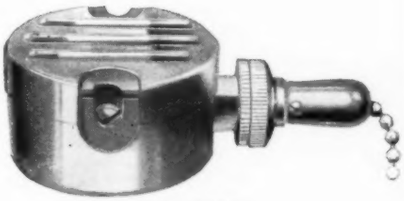
CONSTRUCTION DATA—The room area is 65 feet long by 45 feet wide and has a ceiling height of 13 feet. Both the ceiling and walls are painted aluminum. The average height of the working plane is 3-ft. 6-in.

SOLUTION OF PROBLEM—Since there was a diversity of work performed over the entire area, a flexible system of localized lighting was chosen. Illumination is provided by 16 glassteel diffusers with a 500-watt clear lamp in each, and mounted 8-ft. 6-in. above the floor on trolley duct, one row over each bench.

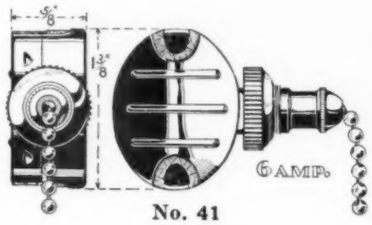
RESULTS—Three weeks after installation the average intensity, for units equally spaced, was 42 foot-candles; directly below three grouped units 120 foot-candles.

TROLLEY MOUNTED *glassteel diffusers provide high-intensity flexible illumination.*

Two *Levolier* Switches that Save Light-Bills and Trouble



No. 1010



No. 41

Today — with inexpensive but durable Levolier Switches for individual control of lights, or fractional H.P. motors — there is little excuse for wasteful use of electricity. McGILL Levolier Switches on test have stood up for over 194,000 "off and on" pulls—showing practically no wear.

NO. 41 THIN MODEL

The smallest 6-ampere switch made — now listed by Underwriters' Laboratories under the "T" rating (6 Amps., "T," 125 Volts; or 3 Amps., 250 Volts). This sturdy little switch will take the initial surge of 48 Amperes from a cold Type "C" lamp — eight times its rated capacity. Can be had in different stem lengths and with link for chain fixtures.

NO. 1010 — 10 AMP.

The only 10-ampere, 125-volt canopy pull-chain switch made. Single-pole control, designed expressly for safe, positive control of modern high-watt and high-intensity lamps. The "T" rating signifies that, in addition to standard Underwriters' test, the switch has had 12,000 more pulls on a lead cold, high-wattage type "C" lamp with initial surge of 80 amperes — 8 times its rated capacity.

Write for Levolier Switch Folder, or see your Electrical Wholesaler for complete details.

ELECTRICAL DIVISION

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Now—MORE LIGHT FOR YOUR MONEY *in Industrial Plants!*

We're down to brass tacks in getting the utmost lighting efficiency out of these new fluorescent lamps. New fixtures, designed for a variety of industrial locations, enable you to select exactly the right "daylight" illumination for each particular job. Porcelain enameled finishes assure highest factor of reflection, long life, and easy maintenance. Installation is simpler, too. All Goodrich Fluorescent Fixtures are furnished complete with ballast equipment, replaceable starters and adjustable brackets for chain or conduit mounting.

GOODRICH FLUORESCENT FIXTURES

THE OLYMPIAN—an R.L.M. closed-end fluorescent fixture; provides a higher degree of light control. Reflector and hood are separable. Uses two 48" fluorescent lamps. May be adjusted to any angle. Catalog sheets are available on the complete line of Goodrich Fluorescent Fixtures. Your copies sent upon request.

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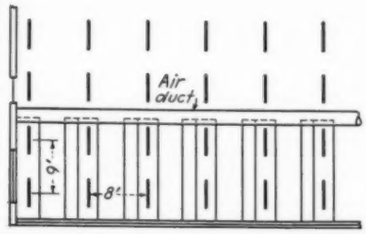
FLUORESCENT LIGHTING *produces high-intensity illumination on the work tables in this eastern chemical laboratory.*

Lighting a CHEMICAL LABORATORY

Fluorescent



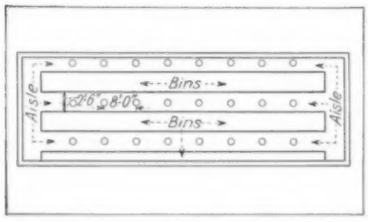
PLAN VIEW *showing the spacing and arrangement of the fluorescent units.*

PROBLEM—To provide high-intensity, cool illumination for chemical laboratory work.

CONSTRUCTION DATA—One side of the room is lined with glass windows. The tables, cabinets and lower half of the walls are painted dark; upper half of walls and ceiling are light. Ceiling height is 9-ft. 6-in.

SOLUTION OF PROBLEM—General illumination is provided by open type fluorescent reflectors, each using two 40-watt daylight fluorescent lamps. The units are conduit suspended from the ceiling, 7-ft. 6-in. above the floor and are spaced on 8-foot by 9-foot centers, above the laboratory tables. A ceiling pull switch controls each individual unit.

RESULTS—The average illumination intensity in the entire room is 35 foot-candles. On the laboratory table tops, directly beneath the units, the intensity is 46 foot-candles; midway between the units it is 28 foot-candles.



PLAN VIEW *showing the spacing and arrangement of the units in the aisles.*

Lighting a STOCK ROOM

Incandescent

PROBLEM—To provide adequate illumination for stock bins arranged in long rows and in tiers of seven, with an aisle between.

CONSTRUCTION DATA—The stock room consists of long rows of steel bins, 8-ft. 9-in. high and containing seven bin tiers. A five-foot aisle separates each row.

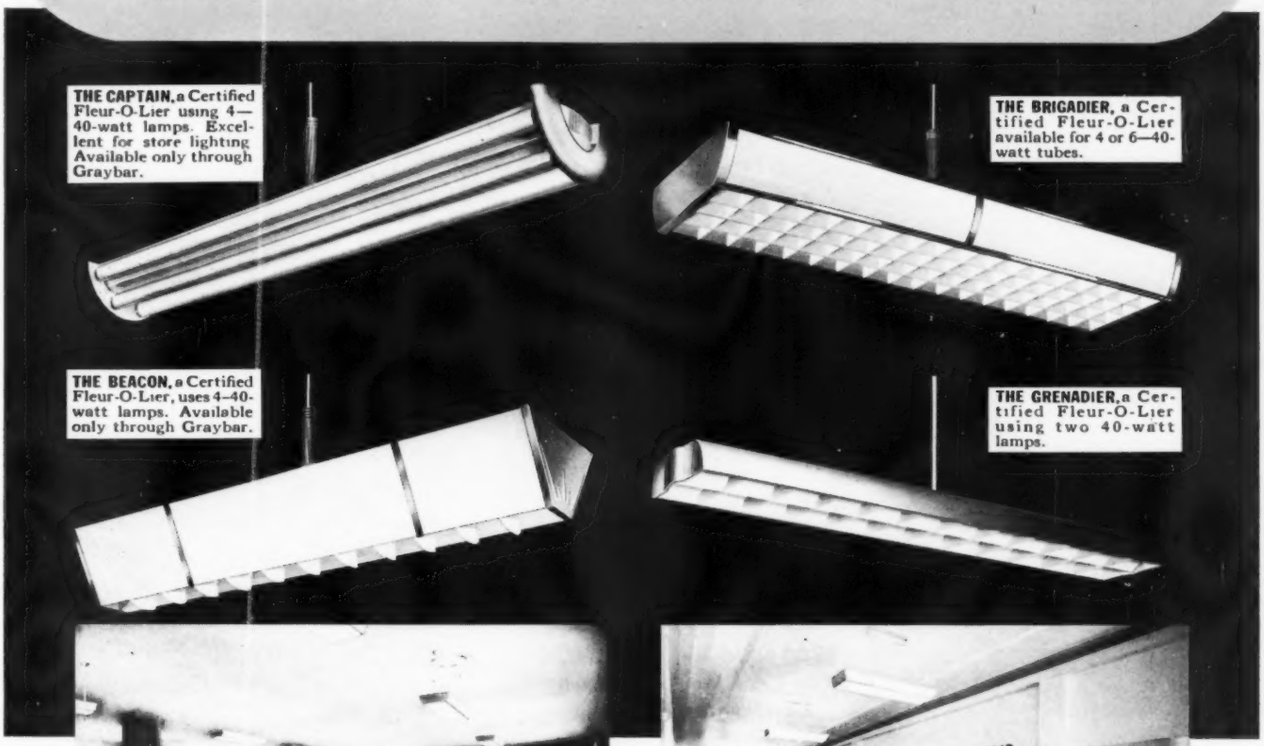
SOLUTION OF PROBLEM—Bin illumination is provided by 250 stock-bin lights, each with a socket extension and using a 100-watt lamp. The units are mounted on eight-foot centers in the center of the aisle and supported by special mounting brackets bridging the aisles. The units are mounted so the horizontal fin is in the same plane as the top of the bin. All wiring is in exposed conduit with group switching at the entrance to each aisle.

RESULTS—Average foot-candle intensities along the vertical plane are as follows: at the units, top bin—6, three middle bins—15, three lower bins—7; between units, top bin—3, three middle bins—7, three lower bins—6.3.

STOCK BIN *lighting with incandescent stock-bin-lights, in the stock room of a manufacturing plant.*

See what WAKEFIELD offers you in *Fluorescent Units*

READY FOR IMMEDIATE DELIVERY



THE CAPTAIN, a Certified Fleur-O-Lier using 4—40-watt lamps. Excellent for store lighting. Available only through Graybar.

THE BRIGADIER, a Certified Fleur-O-Lier available for 4 or 6—40-watt tubes.

THE BEACON, a Certified Fleur-O-Lier, uses 4–40-watt lamps. Available only through Graybar.

THE GRENADIER, a Certified Fleur-O-Lier using two 40-watt lamps.

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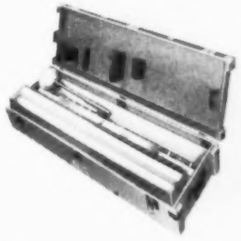
These new Wakefield fluorescent lighting units have been engineered to give top lighting efficiency . . . amazingly better light for stores, offices or other commercial jobs. They're smart. They're modern. They're all Certified Fleur-O-Liers, checked by Electrical Testing Laboratories. In short, these new Wakefield units provide fluorescent lighting at its best. And especially important to you, Wakefield fluorescent units are *ready for delivery now!* See your distributor or write for Wakefield "Bulletin No. 57".

A real sales help . . . the Brigadier demonstrator



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See your GRAYBAR house.

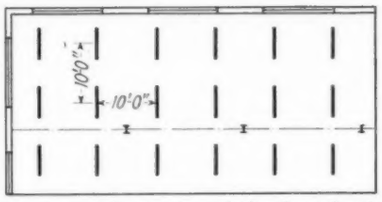
THE F. W. WAKEFIELD BRASS CO.

1000 ECON PARK, VERMILION, OHIO

GENERAL ILLUMINATION *in this machine shop of a mid-west tool manufacturer is provided by 85-watt fluorescent units.*

Lighting a MACHINE SHOP

Fluorescent



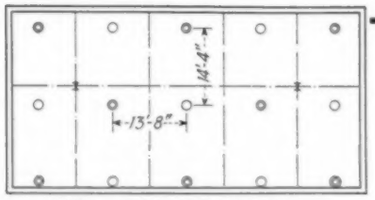
PLAN VIEW *of a portion of the shop showing the spacing and arrangement of units.*

PROBLEM—To provide high-intensity illumination of the proper type to increase efficiency of machine tool operators.

CONSTRUCTION DATA—This department is in a building constructed of cement block walls with large windows on two sides. Steel columns, girders and beams support a wood ceiling, which has an approximate height of 10 feet. Both the walls and ceiling are painted a light color.

SOLUTION OF PROBLEM—General illumination is provided by 85-watt fluorescent units, mounted on the ceiling with hooks and spaced on 10-foot by 10-foot centers. This spacing works out to four units per bay. Wiring is in exposed conduit run in the web of the girder, then up to the wood ceiling and out to the units.

RESULTS—The resultant illumination intensity on the working plane of the machines is 20 foot-candles.



○ 750 watt incandescent units
◎ 400 watt mercury units

PLAN VIEW *showing the location and spacing of incandescent and mercury fixtures.*

Lighting a MACHINE SHOP

Mercury and Incandescent

PROBLEM—To provide high-intensity illumination of the proper type for a large area machine shop in a saw-tooth building.

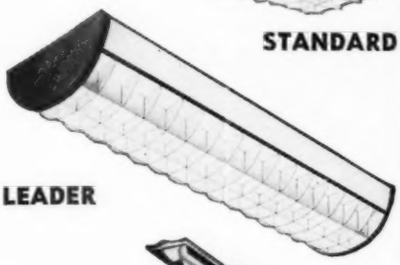
CONSTRUCTION DATA—This building is of brick, glass and steel construction. About two-thirds of the wall area is glass. Steel columns support steel girders and trusses for the saw-tooth roof, one side of which is glass.

SOLUTION OF PROBLEM—General illumination is provided by 144 concentrating type units, 72 of which are 750-watt incandescent units with prismatic glass reflectors in an aluminum shell. The others are 400-watt mercury units with the same type of reflector. The fixtures are conduit suspended from the steel roof purlins and are spaced on 14-ft. 4-in. by 13-ft. 8-in. centers. The mounting height is 22 feet. The units are mounted so that alternate units are of the mercury type. Auxiliaries for the mercury fixtures are mounted on the steel purlins. Wiring is in exposed conduit run in the purlin web.

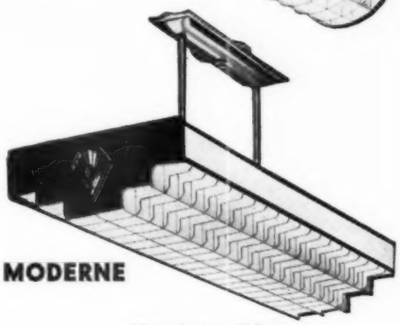
RESULTS—The average illumination intensity on the working plane is 45 foot-candles.

COMBINATION LIGHTING *with incandescent and mercury concentrating units provides high-intensity illumination in this western plant.*

STANDARD



LEADER



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NAME .....

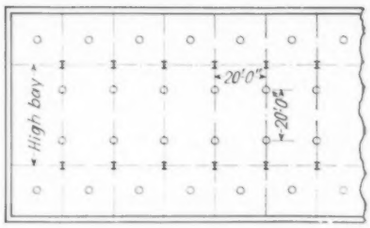
COMPANY .....

ADDRESS .....

HIGH BAY LIGHTING *of this west coast plant was accomplished with concentrating type aluminum reflectors and clear incandescent lamps.*

Lighting a HIGH BAY AREA

Incandescent



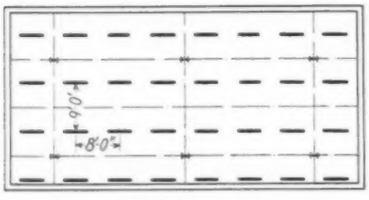
PLAN VIEW *showing the arrangement and spacing of the high bay units.*

PROBLEM—To provide adequate evenly distributed illumination for a manufacturing area under a high bay crane way.

CONSTRUCTION DATA—The high bay area of this building is 40 feet wide with 20-foot bays running the length of the building. Columns, girders and beams are of steel reenforced concrete. The high bay is spanned by steel roof trusses with a wood roof mounted on steel purlins. The two sides of the building consist of glass windows on the upper half and both sides of the high bay monitor.

SOLUTION OF PROBLEM—General illumination is provided by 32 concentrating type Alzak aluminum ceiling reflectors, each with a 1000-watt clear lamp. The units are mounted on the bottom of the steel roof trusses on 20-foot by 20-foot centers with the fixtures 32 feet from the floor to clear the crane.

RESULTS—The average illumination intensity at the floor working plane is 16 foot-candles.



PLAN VIEW *showing the location of the different types of lighting units.*

Lighting a MANUFACTURING AREA

Fluorescent

COOL HIGH-INTENSITY *lighting is provided by fluorescent units in the low bay area of this mid-west industrial plant.*

PROBLEM—To provide high-intensity efficient lighting for the visual tasks involved in manufacturing, assembly and repair work.

CONSTRUCTION DATA—This large industrial area has a ceiling height of approximately 14 feet. Steel columns and beams support the ceiling. Lower half of the walls are painted dark. Upper half of the walls and the ceiling are finished with a light color paint.

SOLUTION OF PROBLEM—General illumination is provided by 106 industrial fluorescent units, each with two 40-watt white fluorescent lamps mounted on a porcelain enameled reflecting surface. The units are spaced on 8-foot by 9-foot centers and mounted 12 feet above the floor. The fixtures are suspended from the exposed conduit runs by perforated band iron and circuit connections are made in a type "C" conduit fitting.

RESULTS—Immediately after installation the average illumination intensity on the working plane was 40 foot-candles.

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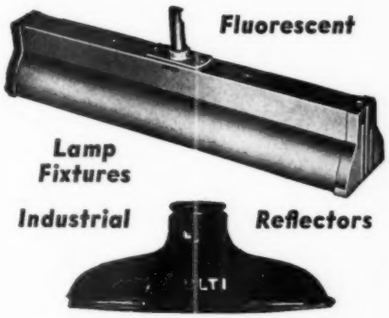

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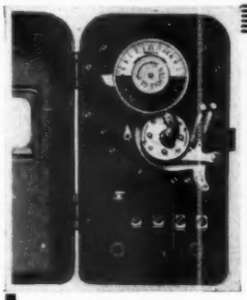

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Use These Low-cost G-E Fluorescent Ballasts

FOR AS LITTLE AS 2% additional cost, you can get all the benefits of high power-factor in your fluorescent installations. Fixtures using G-E single-lamp high-power-factor ballasts or G-E Tulamp ballasts operate at power-factors of 90 per cent and above (instead of 50 per cent) and provide these important advantages:

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2. If new circuits are being installed, you can use smaller wire and still provide a margin of capacity for future additions to your lighting.

3. Losses are lower and voltage regulation is better in feeders and branches; consequently lamp brilliance is higher.

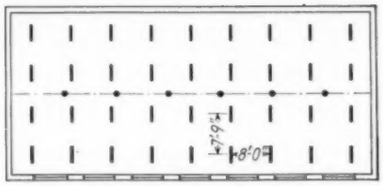
4. Installations fully comply with local regulations on power-factor. All G-E ballasts are listed by Underwriters' Laboratories—all Tulamp ballasts are certified by Electrical Testing Laboratories.

Specify G-E high-power-factor ballasts in *all* your fluorescent fixtures. Their many profitable advantages far outweigh the very slight increase in fixture cost.

Ask your G-E distributor for complete information or write for Bulletin GEA-3293. General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC

FLUORESCENT ILLUMINATION *of an egg cracking room in a mid-west plant.*



PLAN VIEW *showing the spacing and arrangement of the fluorescent units.*

PROBLEM—To provide illumination of adequate quantiy and proper type for the critical seeing tasks involved in an egg cracking room.

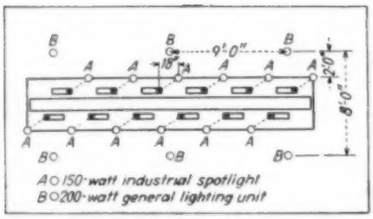
CONSTRUCTION DATA—The room is approximately 70 feet long and 30 feet wide, with white tile walls and a light colored ceiling. The ceiling height slopes from 10 feet at the high point to 8 feet at the low point. A concrete encased steel beam runs through the center of the room.

SOLUTION OF PROBLEM—General illumination is produced by 36 RLM type fluorescent units each containing two 48-inch 40-watt daylight lamps. The units are mounted directly on the ceiling which gives an average mounting height of nine feet. Spacing is on 8-ft. by 7-ft. 9-in. centers. Reflectors and lamps hinge on fixture canopy casing for easy maintenance.

RESULTS—Initial illumination intensities after 100 hours of burning averaged 35 to 40 foot-candles; after three months' use, 25 to 30 foot-candles. Vertical intensities are approximately one-half the horizontal values.

Lighting a GENERAL WORKING AREA

Fluorescent



PLAN VIEW *showing the location and spacing of the lighting units.*

PROBLEM—To provide adequate and comfortable illumination for the seeing tasks involved in operating of sewing machines.

CONSTRUCTION DATA—One corner of a large open work area is devoted to the sewing operation. The mill-type ceiling is white; walls light gray and bench tops light.

SOLUTION OF PROBLEM—A combination of general and localized lighting is installed to give the proper illumination on the colored materials used and the high intensity light necessary at the needle point. General lighting is provided by glassteel diffuser units, each with a 200-watt clear lamp, mounted on 8-foot by 9-foot centers and 9-ft. 6-in. above the floor. For local lighting, one industrial spotlight for each machine is mounted 4-ft. 2 in. above the bench top and about 18 inches from the center of the needle point. Each unit has a 150-watt, clear lamp and louver.

RESULTS—General illumination intensity on the working plane after two weeks' operation is 15 foot-candles. Local lighting intensity is about 200 foot-candles at the needle point.

Lighting a SEWING ROOM

Incandescent

LOCAL LIGHTING *aids general lighting by projecting high intensity light beams on critical points of the machines.*

LIGHTING MFRS. ATTENTION!

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ADVERTISING FORMS FOR 1941 ELECTRICAL BUYERS REFERENCE

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Here is a new line of distinctive, beautifully designed Fluorescent luminaires made especially for general illumination purposes in commercial locations.

These fixtures furnish an abundant quantity of the soft, cool daylight illumination which makes seeing easy and working conditions ideal.

"DAY-LUX" Luminaires, which utilize 40-watt lamps, are available in two- or four-lamp construction.

All fixtures are supplied complete with white lamp holders, high power factor Tulamp ballast equipment, and removable and renewable separate starter switches located on the top of the units.

Reflectors are constructed of white enameled steel. Decorative end caps and canopy finished a beautiful crackled aluminum.

As illustrated, fixtures can be supplied with panels of frosted glass, or without glass.

All units are furnished with ballasts for 110-125 volts, 60 cycle A.C. operation.

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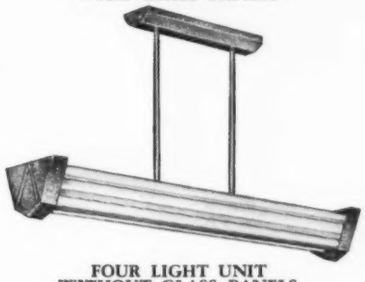
If desired for surface mounting, fixtures will be furnished with 6" stems.

FOUR LIGHT UNIT WITH GLASS PANELS



FOUR LIGHT UNIT WITHOUT GLASS PANELS

TWO LIGHT UNIT WITH GLASS PANELS

TWO LIGHT UNIT WITHOUT GLASS PANELS

For complete data write for New Bulletin No. 65

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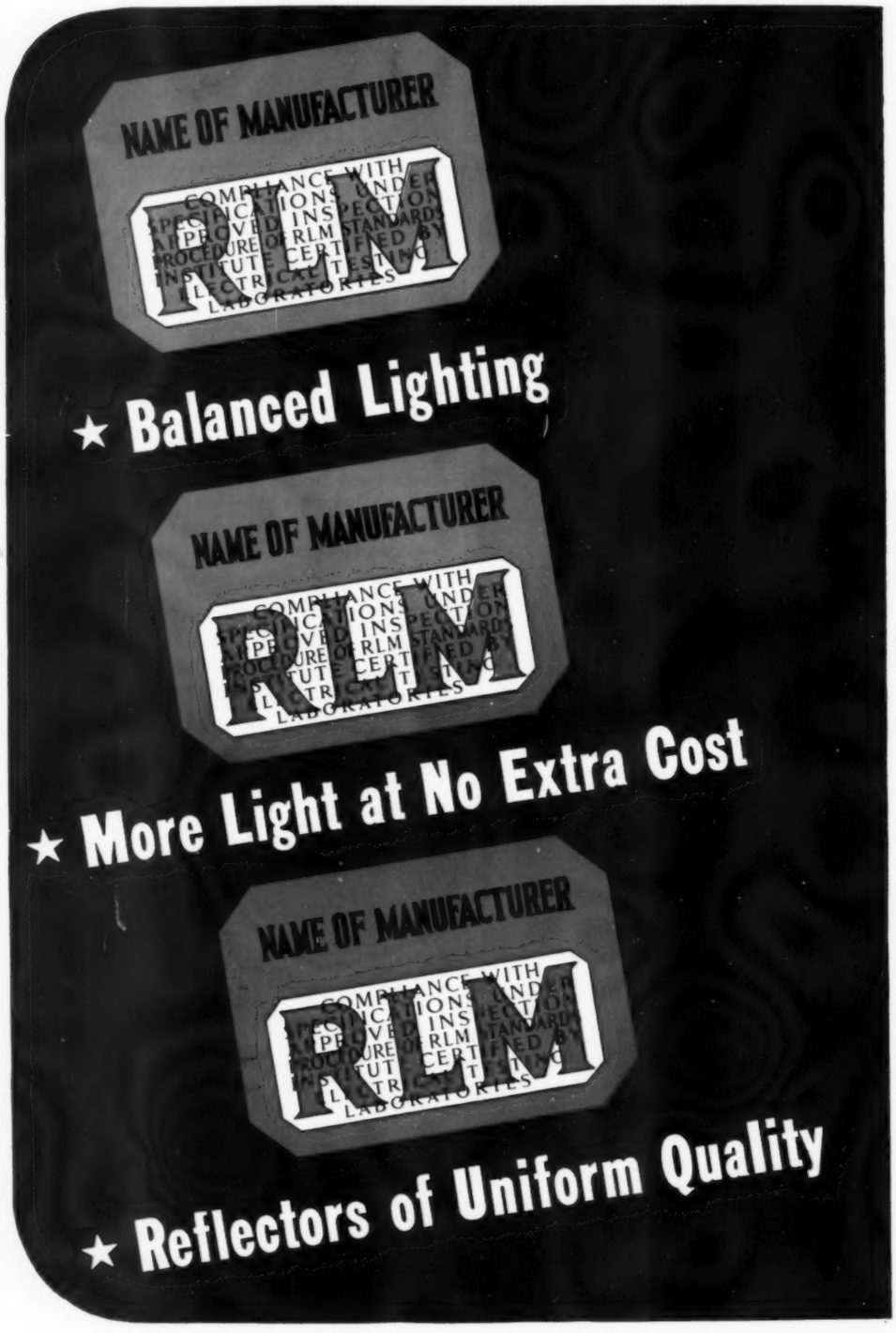
HIGH BAY ALZAK ALUMINUM REFLECTORS



For further information about RLM Units and a copy of the RLM Standards Specifications, you may communicate with any of these manufacturers of RLM Labeled Lighting Equipment. The letters mean Reflector and Lighting Equipment Manufacturers.

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The RLM LABEL certifies that the lighting equipment bearing it conforms to certain high quality standards established by the RLM STANDARDS INSTITUTE. It shows that this equipment has passed exacting laboratory and engineering tests—not readily available to those who purchase and specify—that mean highest lighting efficiency and lower operating and maintenance costs.

When you insist that the lighting equipment you buy or specify must bear the RLM LABEL, you assure yourself, or your client, of maximum value and lasting satisfaction because, basically the RLM LABEL stands for: (1) MORE LIGHT AT NO EXTRA COST—Efficiency specifications are 10-12% higher than average reflector efficiency; (2) BALANCED LIGHTING—Proper distribution and adequate diffusion are just as important as the amount of light. RLM Specification Porcelain Enamel has no known equal as a reflecting surface for Balanced Lighting. (3) LOW REPLACEMENT AND MAINTENANCE COST—RLM Specification high quality porcelain enamel is the most durable of all reflecting surfaces. Being easier to clean, maintenance costs are reduced to a minimum. (4) UNIFORM QUALITY—To insure uniformity of quality and conformance to RLM Specifications, inspections and tests are continuously conducted by the Electical Testing Laboratories of New York, an independent Testing Organization.

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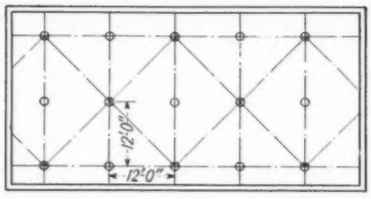
THE CERTIFICATE OF RLM UNIFORM QUALITY

DIFFUSED LIGHTING *for the plane assembly floor of this western aircraft plant, is provided by glassteel diffusers.*

Lighting an ASSEMBLY FLOOR

Incandescent



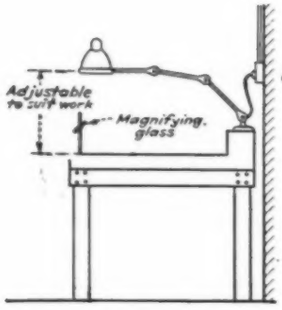
PLAN VIEW *of the assembly area showing the spacing and arrangement of the units.*

PROBLEM—To provide evenly distributed high-intensity general illumination on the assembly floor of an aircraft plant.

CONSTRUCTION DATA—This assembly area is typical of that for all the airplane plants. It is a large expanse of unobstructed floor area with steel trusses supporting a wood saw tooth roof. The distance from the bottom of the steel to the floor is approximately 26 feet.

SOLUTION OF PROBLEM—General illumination in this plane assembly department is provided by 200 ceiling type glassteel diffusers, each equipped with a 300-watt incandescent lamp. The units are mounted on the bottom of the steel roof trusses and are spaced on 12-foot by 12-foot centers, and are 24 feet above the floor. All wiring is done in exposed conduit.

RESULTS—The average illumination intensity on the working plane over the entire area is 20 foot-candles.



SECTIONAL VIEW *showing mounting of reflector on table.*

Lighting an ASSEMBLY TABLE

Incandescent

PROBLEM—To provide high-intensity controlled illumination on a concentrated area of an assembly table where the employees work with small parts.

CONSTRUCTION DATA—The employee sits at the table and assembles small parts of a kerosene lamp. The parts are so small that they must be assembled under a bracket mounted magnifying glass. General illumination or localized-generalized lighting is not sufficiently concentrated for this task.

SOLUTION OF PROBLEM—High-intensity, concentrated supplementary illumination of a strictly local type is provided by aluminum uni-focal reflectors using a 75-watt lamp burning base down. The unit is attached to the back of the table by a three piece flexible metal arm and can be adjusted to the angle and height best suited for the work at hand.

RESULTS—A high-intensity concentrated spot of light is on the working plane, enabling the employee to accurately and rapidly assemble the product.

SUPPLEMENTARY LIGHTING *of high-intensity concentrating type is used for assembling small parts in this kerosene lamp manufacturing plant.*

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1941

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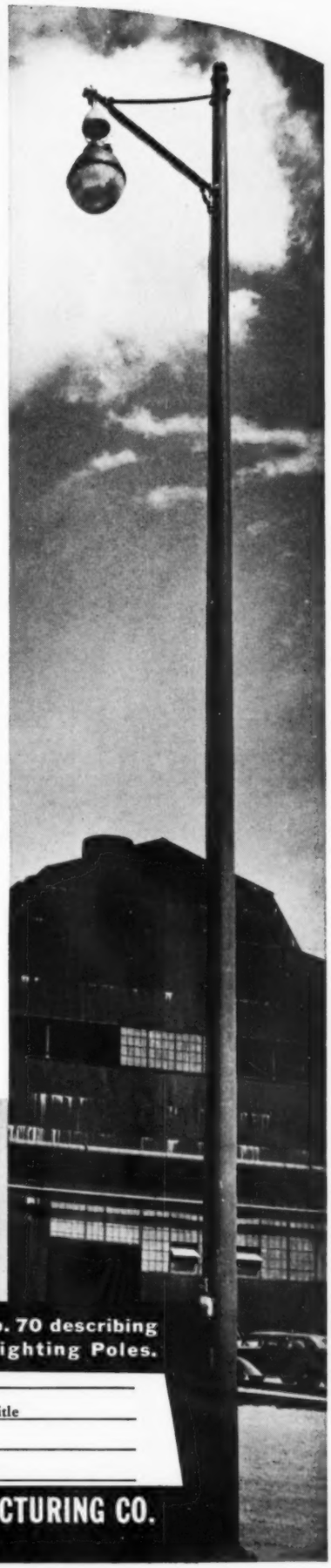
PUT PROTECTIVE LIGHTING

Where you Want It— QUICKLY, SAFELY, PERMANENTLY



● When figuring protective lighting jobs—leave your mounting problems to Monotubes. This complete line of tapered *steel* poles offers a size and type for every lighting service. Each pole is designed to meet the height and strength requirements prescribed for efficient operation. All-steel construction guarantees long life with minimum maintenance, and their light weight speeds and simplifies erection.

Protective lighting business is going places. Get ready! Write for catalog describing Monotube Floodlighting Poles. And rest assured that, when you want Monotubes, Union Metal has both the stock and personnel to fill your requirements in a hurry.

Typical Monotube Pole application for protective lighting as installed recently by a large steel plant. Features disconnecting cut-out device which permits luminaire to be lowered by hand for relamping, cleaning, etc.

Send me copy of your Catalog No. 70 describing Union Metal Monotube Floodlighting Poles.

Name _____

Company _____ Title _____

Address _____

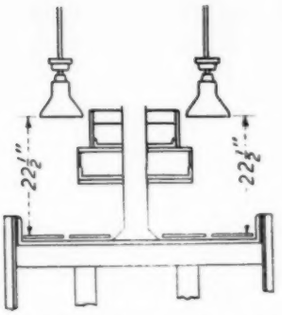
City _____ State _____

THE UNION METAL MANUFACTURING CO.
CANTON, OHIO

END-TO-END MOUNTED *fluorescent units provide high-intensity cool illumination over this inspection table in a western fruit company.*

Lighting a FRUIT INSPECTION TABLE

Fluorescent



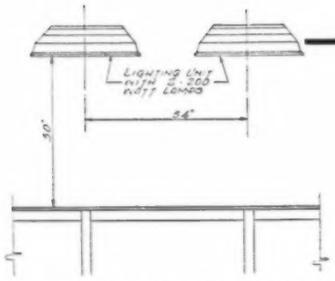
SECTIONAL VIEW *showing the fluorescent units over a fruit inspection table.*

PROBLEM—To provide cool high-intensity illumination necessary for fruit inspection.

CONSTRUCTION DATA—The inspection table consists of a long bench equipped with a number of troughs and conveyor belts. Workers sit along both sides of the table and inspect fruit moving on the conveyor.

SOLUTION OF PROBLEM—High-intensity illumination is provided by 16 30-watt, 36-inch fluorescent units mounted end-to-end, 22½-inches above the conveyor belt, to form a continuous trough of light. Each section contains one 30-watt daylight fluorescent lamp. Eight units are mounted over each side of the table and are supported by a wood beam suspended from the ceiling.

RESULTS—Average illumination on the working plane after 200 hours operation is 100 foot candles.



ELEVATION *showing the spacing and mounting heights of the lighting units.*

Lighting an INSPECTION BENCH

Incandescent

PROBLEM—To provide suitable illumination to eliminate shadows and to facilitate locating flaws in rough iron castings.

CONSTRUCTION DATA—The inspection bench is a long table over which automobile engine castings are carried by a belt conveyor. Inspection of the castings, fresh from the foundry, for sand holes, fins, burrs and other defects and the removal of same is a continuous operation over an eight-hour shift.

SOLUTION OF PROBLEM—Direct incandescent illumination is provided by a number of skylight type of units, each of which contains two 200-watt clear lamps mounted under a large reflector and covered by flashed white opal glass. The units are mounted over the center of the table on 4-ft. 6-in centers and suspended 50-inches above the working plane on coiled springs to minimize vibration.

RESULTS—The illumination intensity at the middle of the conveyor belt is 55 foot-candles on the horizontal; 30 foot-candles on the vertical along the conveyor line.

CRITICAL INSPECTION *tasks are made easy by high-intensity direct illumination from large-area reflector units.*

LIGHTING MFRS. ATTENTION

GONE!

AFTER

OCT. 18

THE ELECTRICAL BUYERS REFERENCE GOES TO PRESS

LIGHTING MANUFACTURERS WIRE RESERVATIONS COLLECT, NOW

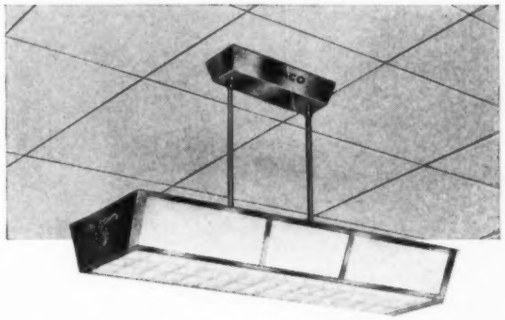
ELECTRICAL BUYERS REFERENCE

330 W. 42 ST., NEW YORK, N. Y.

Four-Light Commercial

FLUORESCENT Lamp Fixture

for Stores and Offices



Designed to give the highest efficiency in diffused illumination downward as well as an even distribution of light on ceiling and side walls. The egg crate louvre gives a cut-off at a 45° angle with very little absorption of light. The sides are plastic which eliminates breakage. Fixtures are equipped with high power-factor (95–100%) tulamp ballasts with starting compensators for each ballast also lamp holders and removable starting switches. Finish is satin silver bronze outside, inside and louvre is white enamel. Canopy and hangers are satin cadmium. Suspension and ceiling types. Send for our bulletin which gives details and prices or see your Wholesaler.

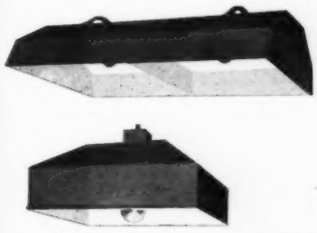
OVERBAGH & AYRES MFG. CO. 411 S. CLINTON CHICAGO, ILL.

LIGHT FOR SEEING

On the Job

Engineered Equipment for *Localized Lighting* of Every Industrial Task

FLEXIBLE ARM MACHINE, BENCH AND TABLE MODELS



FLUORESCENT AND SILVER BOWL CANOPY MODELS

In engineering departments, on production and inspection lines, in machine and tool rooms—a worker is no better than his ability to see what he is doing. On precision work he needs the quality and quantity of illumination which can be provided only by localized lighting—light directly on the job and under his control . . . Fostoria Localites are designed and built to provide proper Light for Seeing quickly, easily and economically. They pay real dividends in faster production, better workmanship and lower costs as evidenced by thousands of industrial concerns who now use this modern equipment. May we send you further information?

★ FREE—Handbook of Localized Lighting. Send for a copy.

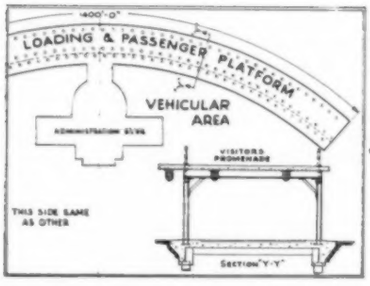
ENGINEERED fostoria LOCALITE

THE FOSTORIA PRESSED STEEL CORP.
FOSTORIA, OHIO

PROTECTIVE LIGHTING *in this factory yard effectively discourages the saboteur.*

Lighting a FACTORY YARD

Floodlighting



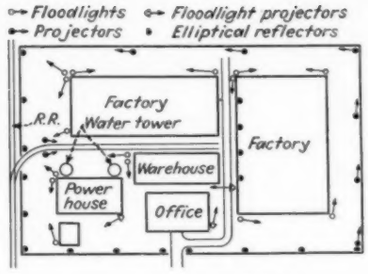
PLAN AND SECTION *views showing the spacing and mounting arrangement of the platform lights.*

PROBLEM—To provide illumination of the proper type for an airport passenger and loading platform which is subject to severe weather and dust conditions.

CONSTRUCTION DATA—The platform is 1400 feet long and is in the shape of a wide arc, extending equidistant on two sides of the administration building. It is 20 feet wide and has a 10-foot white re-enforced concrete ceiling which projects as a canopy four feet over the vehicular area. The side facing the runways is glass enclosed and has numerous exits for passenger use.

SOLUTION OF PROBLEM—General illumination is provided by 420 ceiling type vapor-tight fixtures, each with a 60-watt standard incandescent lamp, a clear glass enclosing globe and a metal guard. The units are arranged on 10-foot centers in three rows, one in the canopy and two in the platform ceiling. All conduit is concealed in the concrete slab with the outlet boxes set flush with the finished ceiling.

RESULTS—Uniform illumination intensity, after one year was 5 to 6 foot-candles.



TYPICAL PROTECTIVE *lighting arrangement for fences and buildings.*

GENERAL PROBLEM—To provide adequate illumination on fence lines, sidings, roads and outside of buildings to guard against theft and sabotage.

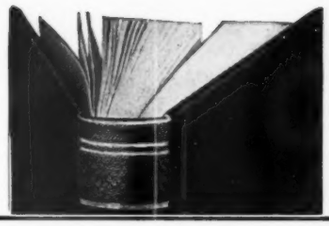
CONDITIONS—Fencing usually provides a clear space between buildings and roads. Buildings, roofs and posts may be used to mount units to cover interior roadways, sidings, etc.

METHODS—Fences may be lighted with narrow beam projector inside corner posts, with additional projectors every 300 feet. Double range projectors, floodlighting foreground and projecting a flood on building protect smaller buildings in open area. Ordinary open floodlights may light sidings and roads.

Lighting an AIRPORT PLATFORM

Incandescent

CORRIDOR LIGHTING *of this large eastern airport passenger and loading platform is accomplished with vaportight fixtures.*



How to wire *for residential, farm and industrial* lighting

Step-by-step methods fully and simply explained in this new book.

H. P. Richter's

PRACTICAL ELECTRICAL WIRING

500 pages, 5½ x 8, illustrated, $3.00

HERE is a complete course of instruction for those who want to learn how to do electrical wiring. Begins with very first elements and takes the reader by easy steps, plain instructions and methods, to the completion of typical wiring jobs in accordance with official requirements. Employs simple language; confines mathematics and theory to the minimum necessary for understanding of the work; covers medium voltage jobs of the types that are most in demand.

Covers:

I. Underwriters and codes; electrical principles and measurements; basic devices and circuits; wire, sizes and selection; connections and joints; residential and farm motors; etc.

II. Planning an installation; specific outlets; switches and other devices; old work; farm wiring; isolated lighting plants; wiring apartment houses; etc.

III. Planning non-residential installations; non-residential lighting; miscellaneous problems; wiring for motors; wiring schools, offices, stores, churches; etc.

"Here is one book which is understandable, interestingly written, with many illustrations showing how to do wiring and which do not leave details to the imagination."—*Electricity on the Farm.*

10 DAYS' EXAMINATION

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Send me Richter's Practical Electrical Wiring for 10 days' examination on approval. In 10 days I will send $3.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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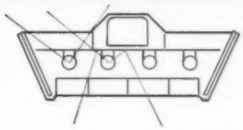
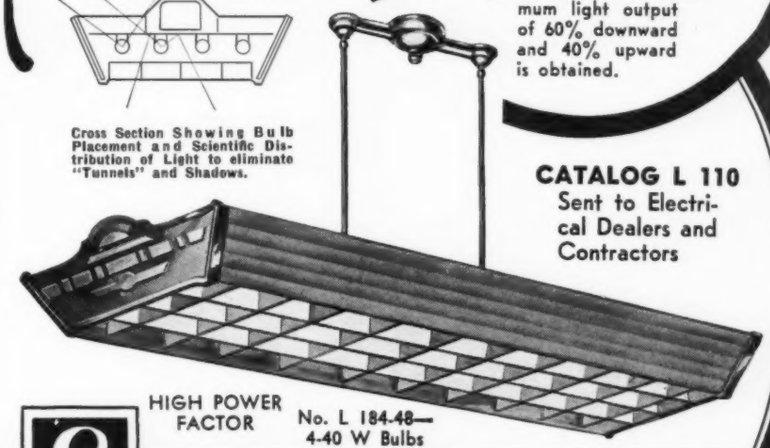
GLARELESS FLUORESCENT by EFCOLITE

A NEW Efcolite Fluorescent unit designed to provide increased high levels of illumination with the cool light from four fluorescent lamps. Glass sides and an open grille bottom conceal the bulbs from direct view, which are placed so that a maximum light output of 60% downward and 40% upward is obtained.



Cross Section Showing Bulb Placement and Scientific Distribution of Light to eliminate "Tunnels" and Shadows.

CATALOG L 110
Sent to Electrical Dealers and Contractors



HIGH POWER FACTOR

No. L 184-48—4-40 W Bulbs

EFCOLITE CORPORATION TRENTON, N. J.

Badger

Synchronous ELECTRIC TIME SWITCHES

CONTRACTORS LIKE THEM BECAUSE:
they are dependable and easy to install

USERS LIKE THEM BECAUSE:
of economical operation and low cost

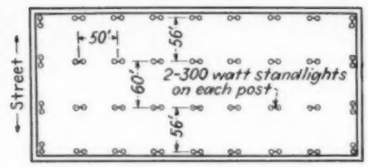
The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET RACINE, WISCONSIN

PARKING LOT *lighting with double stand lights between the rows of parked cars.*

Lighting a PARKING LOT

Incandescent



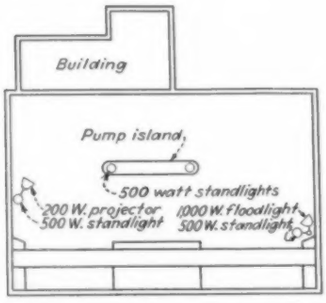
LAYOUT *of parking lot shows spacing of lighting equipment.*

PROBLEM—To provide high quality glareless lighting of adequate intensity for a large customer parking lot connected with a retail store.

CONDITIONS—The lot measures approximately 180- by 350-ft., fronting on a street. Cars are parked in marked rows by their own drivers. There are three drives through the lot with parking spaces at both sides of each drive.

SOLUTION OF PROBLEM—Double stand light units on 12-ft. poles are installed in rows on both sides of the lot and between the roadways. A total of 32 poles and 64 stand lights reflectors are used with 300-watt incandescent lamps in each.

RESULTS—On 50- by 56-ft. spacing, approximately 10 foot-candles is obtained in the parking rows and 3 to 4 foot candles in the center of the roadways.



LAYOUT *showing the location and arrangement of floodlighting units.*

Lighting a SMALL GAS STATION

Floodlighting

SMALL GAS *station lighted from stand lights and floodlights at the lot line.*

PROBLEM—To provide adequate general illumination for servicing automobiles and for attractive building and lot floodlighting.

CONSTRUCTION DATA—The lot is approximately 80-ft. wide with a single three pump island in front of the station building. The building is finished in white with blue trim.

SOLUTION OF PROBLEM—Stand lights with 500-watt lamps are installed at either side of the driveway lot and at either end of the island. One 1000-watt floodlight on a 20-foot pole lights the ground and building from one corner of the lot. Another small 200 watt projector above the opposite stand light illuminates the building front.

RESULTS—An average of 20 foot-candles within the servicing area is obtained with bright, attractive building floodlighting.

"We recommend private telephones for inter-office business."
—Office Manager

"I'm busy and interior telephones save me a lot of steps."
—Stock Broker

"Serv-U-Fones meet our modest needs perfectly—and inexpensively."
—Shop Proprietress

"I use our Idealfone system 50 times a day."
—Storekeeper

"Best investment we ever made."
—Factory Owner

Who Buys AUTOMATIC ELECTRIC PRIVATE TELEPHONE SYSTEMS?

Those who buy Automatic Electric private telephone systems are the kind of people you deal with every day. They are just clear-thinking men and women who appreciate the time- and step-saving advantages of convenient interior communication.

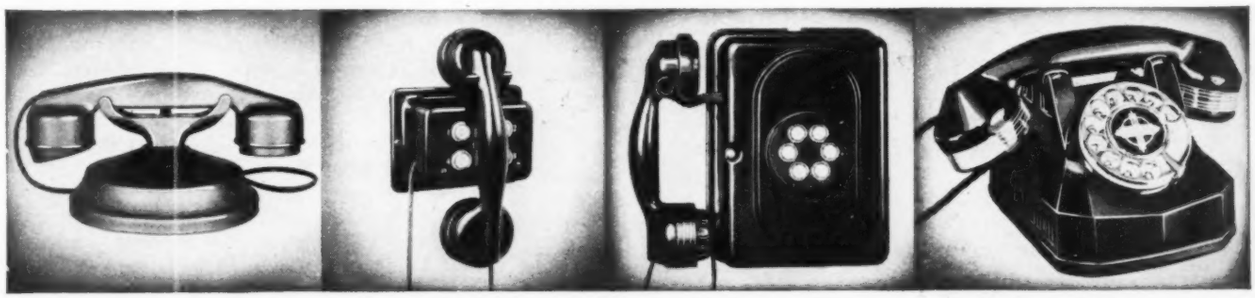
They realize that no matter how small or how large their establishments, Automatic Electric private telephones help them to do a better job—faster—more economically.

Many more of the same kind of folks not yet enjoying interior telephone service are going to buy equipment—and from you if you'll let them.

When you handle the profit-producing Automatic Electric line, you can offer your customers an interesting variety of systems and accessories from which to choose. Four types of systems are shown here.

Your local electrical wholesaler will be pleased to furnish you with full information, literature and prices on the complete line. Talk to him today!

Automatic Electric intercommunicating systems are designed for private service. They are not intended to be connected with the public telephone system.



SERV-U-FONES

Low priced, all metal telephones, in common talking systems of two to ten stations. Conveniently packaged and simple to install.

IDEALFONES

Wall type with molded handsets. Offered with one or five buttons for common talking service up to ten stations.

INTERCOMS

Supplied in both desk and wall styles—with molded plastic handsets. Common talking systems of two to eleven stations.

P-A-X's

Private automatic exchange systems, providing dial service and secret connections, from ten stations up. Telephones in a variety of types.

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PRIVATE INTERIOR TELEPHONE SYSTEMS

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Motor Shops

STATOR STRIPPING BENCH

The motor repair department of the L & P Electric Company, Brooklyn, N. Y., has designed and built a revolving stator stripping bench that has a "pump action" pulling mechanism.

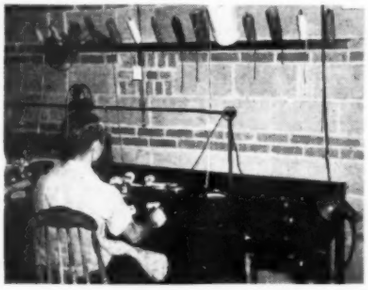
The 29-inch table, which stands two feet above the floor, revolves on a pedestal base and has eight 4-inch radial slots with adjustable J clamps for holding the stator. The pulling mechanism consists of a 41-inch lever arm, with five 1½-inch horizontal adjustments, pivoted on a 2-inch removable center pipe shaft. This shaft also revolves and has five 4-inch vertical adjustments made possible by the insertion of a pin in holes drilled through the shaft. The pin rests on a revolving grooved base at the table top. A pair of gripping pliers are chain attached to the lever arm so that pressure on the arm tightens the grip of the pliers on the coils and pulls them from the slots.

The revolving table and lever arm enables a man to strip an entire stator without changing his position. It also permits the stripping table to be placed against a wall or in a corner out of the way.

***PUMP ACTION** lever arm with vertical and horizontal adjustments plus a revolving table makes stator stripping easy in this motor shop.*

RACK FOR INSULATED SLEEVING

A rack for holding spools of insulated sleeving is mounted three feet above the work bench at the Electrical Motor Repair Co., Trenton, N. J. It consists of a 7-foot length of 2½-in. by 2½-in. angle iron with fourteen $\frac{5}{16}$-in. bolt studs, each 7-in. long and mounted on 6-in. centers at about a 40 degree angle to the wall.



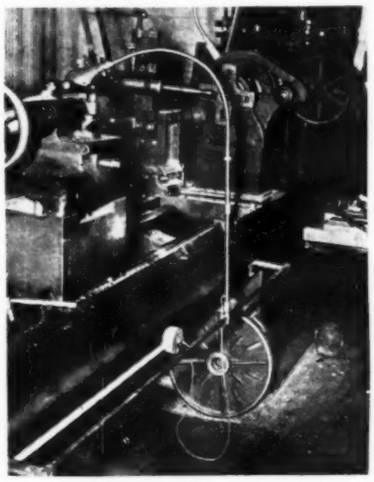
***SLEEVING RACK** holds 14 different colors and sizes of insulated sleeving within easy reach of the coil winder.*

With this arrangement all the different colors and sizes of sleeving are within sight and easy reach of the mechanic working at the bench. Empty spools can be quickly and easily replaced.

SLIDING LATHE LAMP

The Electric Maintenance Company of Boston has solved the inadequate light problem on its work benches and lathes by designing and building a gooseneck lamp which slides along a supporting bar. The lamp can be moved along the entire working surface of the lathe, assuring proper light at the working point all the time.

The lamp support consists of a long flexible gooseneck mounted on a short length of ¾-in. conduit which is supported by a square steel collar sliding along a square bar. The bar, long enough to cover the lathe bed, is mounted to the back of the lathe by means of right angle, flat iron brackets. A receptacle mounted on the lathe frame and an extension cord and plug complete the electrical connection. The same principle is applied to the work bench lamps, so concentrated light can be had at any point on the bench when desired.



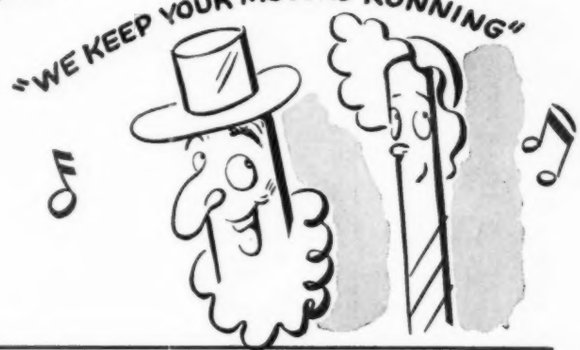
***SLIDING SUPPORT** for the lathe lamp provides concentrated light at any point along the length of the lathe bed.*

COIL WINDING FORMS

Although adjustable winding heads are used by many shops for coils, California Electric Works, San Diego, Calif., finds that it saves time to make use of this "library" of winding forms. A complete assortment of forms for the various types and kinds of coils for motors or for control equipment have been built of plywood and varnished. These are indexed and arranged in such

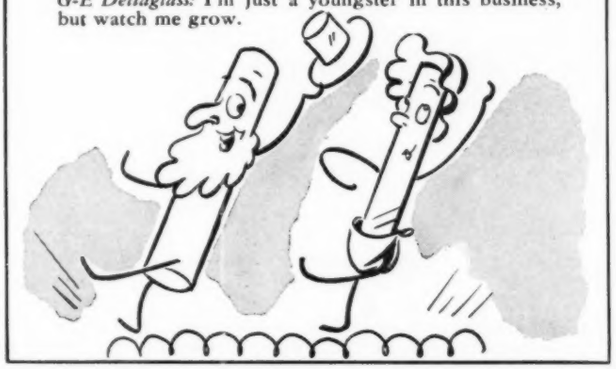
***TWO WINDING LATHES** on which the forms are mounted. Each lathe has two winding heads and is capable of a wide range of speed regulation.*

Meet the G-E Magnet Wire Boys



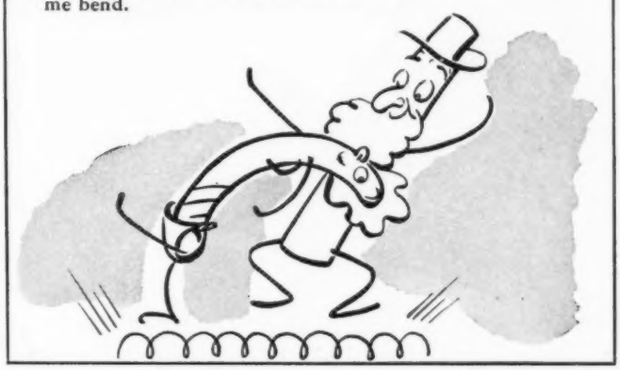
G-E Deltabeston: Engineers and motor repair men know me well. I've protected motors from electrical breakdowns for years.

G-E Deltaglass: I'm just a youngster in this business, but watch me grow.



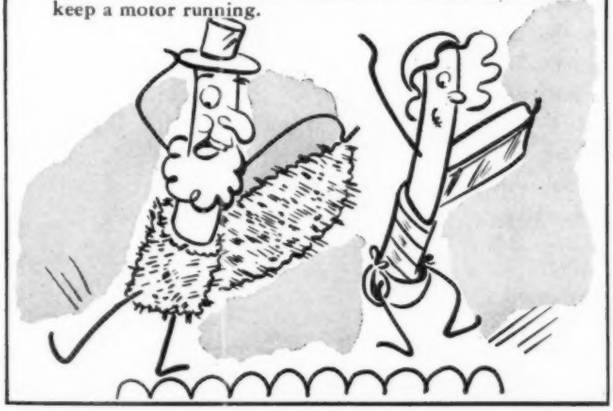
G-E Deltabeston: My copper is pure and so pliable that I'm easy to handle.

G-E Deltaglass: Talking about soft copper—just look at me bend.



G-E Deltabeston: It's hard to beat asbestos for heat resistance, and my insulation is PURIFIED ASBESTOS.

G-E Deltaglass: My insulation is PURE, SODA-FREE SPUN GLASS. Glass can stand a lot of heat and still keep a motor running.



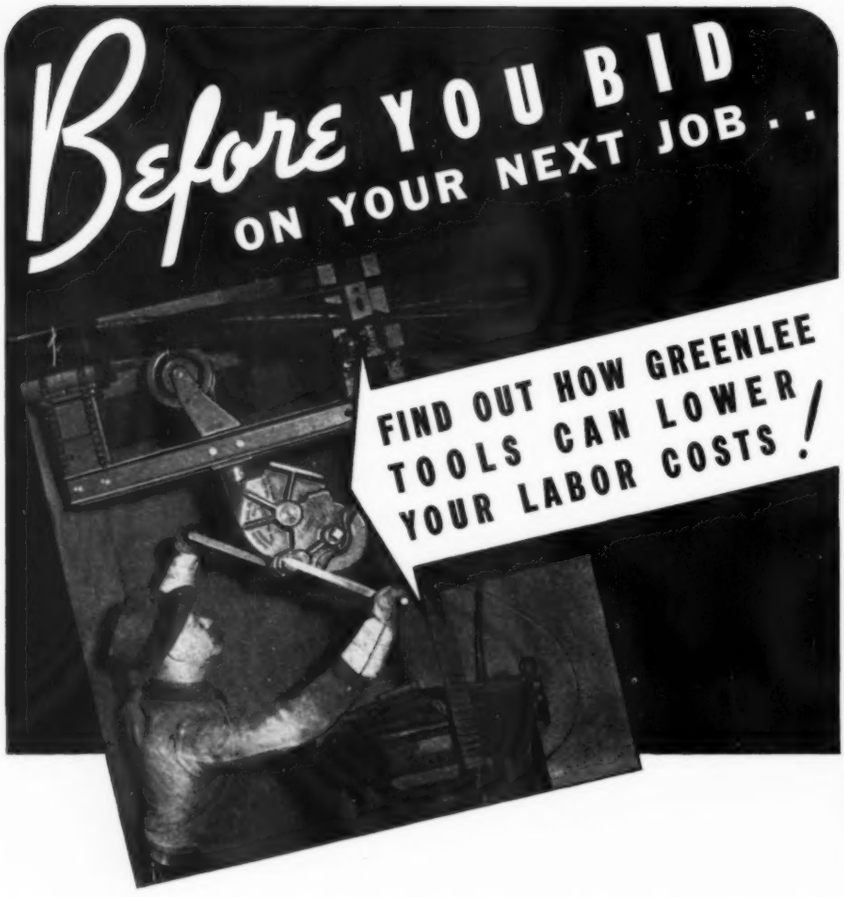
G-E Deltabeston: Moisture doesn't bother me. I can stand a lot of it.

G-E Deltaglass: Me, too.

In motor repair work these are applications where Deltabeston Magnet Wire will do the better job. For some jobs, Deltaglass is superior. But you can't go wrong, whichever you use.

Send for the G-E Magnet Wire Bulletin today. Section Y-0120, Appliance and Merchandise Department, Bridgeport, Connecticut.

GENERAL ELECTRIC



Before you bid on the next job consider the labor cost item. The one way for you to cut labor costs is to have fast, efficient tools, . . . tools to make it easier and faster for the man on the job. And Greenlee Tools were designed for just that purpose. For instance the Greenlee Cable Puller, shown above, is a tool that will save many hours of work when pulling in cable. This handy tool clamps right on to the conduit through which the cable is pulled, and cuts pulling time in half. Then for bending jobs there's the Greenlee Hydraulic Benders for conduit from 1¼ to 4½-inch, to cut labor costs and eliminate many manufactured bends and fittings. Look into the complete line of Greenlee Tools today . . . just send coupon below for Catalog 31E.

Other GREENLEE tools to Save you Money

- Hydraulic Pipe Pushers
- Knockout Tools
- Bit Extensions
- Joist Borers
- Electricians' Auger Bits

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ALSO INFORMATION ON.....
Name.....
Address.....
City..... State.....
My Jobber is.....

GREENLEE
HAND TOOLS FOR THE ELECTRICAL WORKER

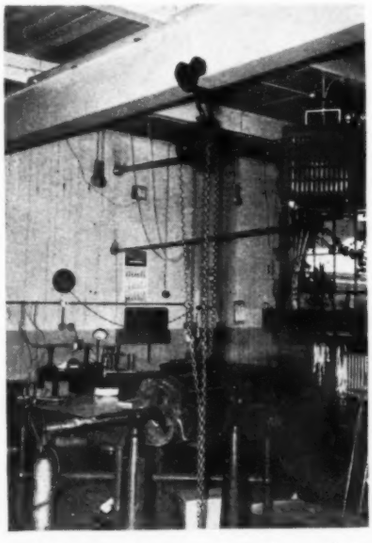
Motor Shops

[FROM PAGE 70]

a manner that the shop man takes the required form from the "library" as directed by the work order, mounts it immediately and quickly on either one or the other of the two winding lathes and is all ready to start winding. No measurements are necessary nor adjustments either. He just starts to work winding. Immediately upon finishing,

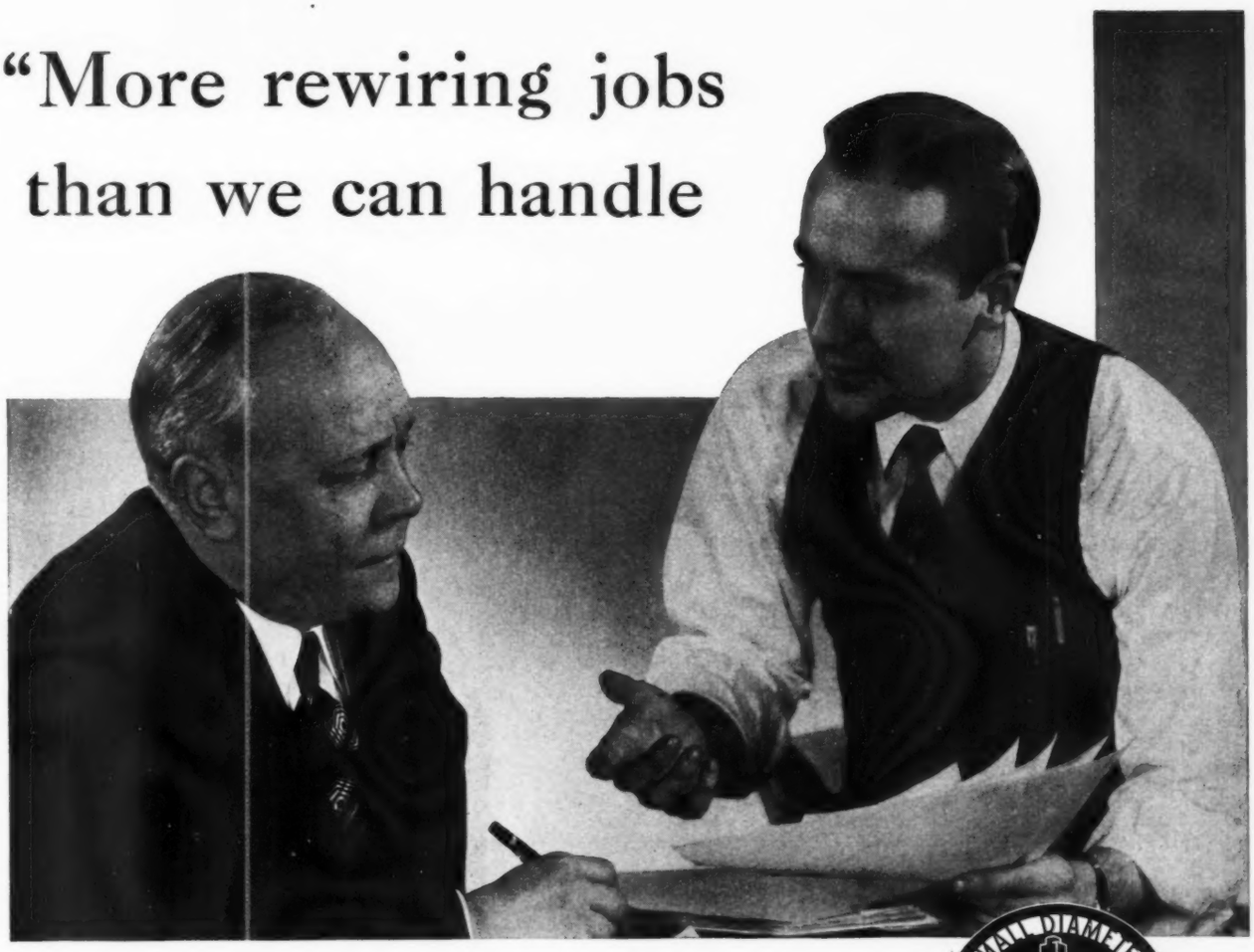
"LIBRARY" of standard coil winding forms made of plywood and arranged for quick selection.

he can put the coil back in its required place. Each form has a slot through which the magnet wire for the lead is placed. This also acts as a means of starting the coil winding. Where several coils have to be wound in a gang, several of the blocks can be fastened together on the lathe.



***BEAM TROLLEY** with a 1½-ton chain hoist is used on the structural steel beams of the winding room of the Electrical Engineering and Service, Inc., Westfield, Mass. It simplifies the handling of heavy equipment.*

"More rewiring jobs than we can handle



thanks to these new AMPEROX *Small-Diameter Building Wires"*

"BUILDING operators in this district were up against it. They were losing tenants because they couldn't supply enough electrical capacity. And their old conduits were loaded to the hilt. We could understand why they didn't want to go to the expense and nuisance of ripping out the old conduits and installing new and larger ones.

"But that's all changed now. These new Amperox Small-Diameter Building Wires make it possible to double or even triple present current-carrying capacity without over-filling the old conduit. In one rewiring job, we cut the estimated cost from $70,000 to $10,000; and in a smaller job, from $408 to $185.

"Now we're getting more rewiring jobs than we can handle. With costs down to a fraction of what they were before, building operators are installing adequate wiring without waste of time."

COMPLETE LINE—American Steel & Wire Company produces a complete line of small-diameter building wires, including Amperox heat-resistant grade (Type RHT), Amerite performance grade (Type RPT), and Ampyrol synthetic insulated (Type SN). All are produced with the same quality and precision which characterize electrical wires and cables by American Steel & Wire. Write for data.

SMALL DIAMETER
AMPEROX
BUILDING WIRES

Comparative Diameters

Standard Type R Code Wire

	8	10	12	14
Rubber	4/64"	3/64"	3/64"	3/64"
O.D.	.290"	.230"	.210"	.190"

Amperox Small-Diameter Wire Type RHT

	8	10	12	14
Rubber	3/64"	2/64"	2/64"	2/64"
O.D.	.250"	.200"	.180"	.160"

Approved by Underwriters' Laboratories

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

Sell Infra-Red Heat

[FROM PAGE 24]

will affect a great saving especially during the summer months.

The lamp bank is 9-ft. 4-in. long consisting of two rows of 13 reflectors and 240-watt lamps mounted on wiring channel. The reflectors are 7½-in. in diameter spaced 8½-in. apart lengthwise and 10½-in. center to center between the rows. The bank is supported by 1-in. by ⅛-in. perforated band iron from the wood joists above. Each of the band iron supports consist of two pieces fastened together with bolts, 18 inches above the bank, providing a means of adjusting the height of the lamp bank above the bench.

Each row of lamps is connected by an armored flexible lead to a 30-amp. externally operable fused switch. The switches are fed by two No. 8 conductors in a ¾-in. electrical metallic tubing from a 40-amp. fuse cutout at the distribution center.

In the manufacture of radio speakers, another Chicago plant has the problem of drying lacquer and glue on the speaker cones. Some 88 carbon lamps of 260 watts are mounted in reflectors in a framework over a continuous moving belt. The speakers pass under the lamps at a distance of 8 inches at a rate of 2-ft. per minute. The concentration is 2.4 watts per sq. in. on the work.

In this installation the lamp banks are suspended from flat iron yokes built up over the conveyor belt. Threaded rod fastened to the wiring channel with wing nuts at the yoke provide a means of vertical adjustment.

The field of application for industrial radiant heating is practically unlimited. Experimental work is going on every day to find new uses. Processes and material are being specially designed to fit the technique. Most effective sales tool yet found is a simple and inexpensive trial bank of lamps in an adjustable frame that can be set up in the customers plant and connected to a spare circuit.

Infra-Red in Hazardous Locations

Chairman Benjamin Richards of the Committee on Manufacturing Hazards, NFPA, has published the following suggestions for guidance in installing infra-red drying where there are possibilities of fire hazards:—

1. All electric equipment should be of approved type and installed in accordance with the National Electric Code.

2. In drying goods involving the evaporation of considerable amounts of flammable solvents by infra-red lamps such installations should not be confined in small rooms unless such rooms are thoroughly ventilated by natural or forced draft systems.

3. Where the evaporation of a considerable amount of flammable solvents is involved, ventilated hoods or enclosures should be built at the first part of the conveyor with exhaust systems to discharge the first evaporation from the solvents outside so that when the goods progress to the lamp drying tunnels a comparatively small amount of solvent is left for evaporation. Preferably a space between such ventilating section and the drying section should be maintained.

4. A similar ventilating system could be installed to precede the drying where goods give off flammable dust, waste, deposits, etc., which might collect on the drying lamps.

5. Lamps and other electrical equipment should be kept free from flammable deposits and adequate cleaning carried out as a regular program where needed.

6. Lamps drying units should be well separated from spraying and dipping processes.

7. Controls should be provided so that the lamps in the tunnels will be shut off automatically if and when the conveyor stops.

8. If there are no conveyors, the goods being left stationary in the dryer, there should be a time switch to shut off the lamps to avoid overheating the stock if it is not removed from the dryer on time. That would guard somewhat against the ever-present hazards of human error.

9. Goods on conveyors should be rigidly supported so as to be not liable to displacement and so cause lamp breakage and short circuits. Where there are no conveyors, goods should be fixed on dollies running on tracks to accomplish the same result.

10. Special protection, if required, should consist of automatic sprinklers or approved water spray systems over the lamp tunnels and under ventilating hoods or an approved automatic CO_2 gas fire extinguishing system should be provided.

"We had to put glasses on our electric eyes—they were getting a little near sighted."

AMERICA PREPARES!
Now more than ever you need
WESCO
SERVICE and STOCKS
•
WHAT YOU NEED
WHEN YOU NEED IT
WHERE YOU NEED IT
FROM ONE SOURCE OF SUPPLY
Westinghouse
Westinghouse
Electric Supply Company
The name that means everything in electricity
A NATIONAL DISTRIBUTING ORGANIZATION WITH 77 BRANCHES

WHAT WESCO SERVICE means to you—

Westinghouse Electric Supply is a NATIONAL organization. Its whole existence is founded upon its ability to provide prompt, adequate service to its customers. Our service takes many forms . . .

SALESMEN are more than just order takers. They offer you the various services listed on this page. In addition, they have a fund of knowledge about products, price trends, modern display methods, and so on. Use these men—you can rely upon them!

ENGINEERING assistance is invaluable when you must apply new products, or are doing specialized kinds of work. WESCO has a corps of specialists available, ready to help you. And our connections with manufacturers make their engineers quickly available also.

REGULAR delivery routes in all important localities assure you that you can get *what you want, where you want it, when you want it.* Special delivery service is always available in emergencies, and large orders can be delivered on an exact time schedule arranged to suit your needs.

VITAL strength of our organization is the "inside man." The first time you deal with us by telephone you will find you are quickly connected to a seasoned man who has acquired a wealth of information over the years. And if he doesn't have the answer at once, he'll get it for you quickly.

INFORMATION that is hard-to-get can be found at WESCO houses. We keep on hand catalogs, data books and engineering information on thousands of products. And our personnel is made up of experienced electrical men who know the business. Prices — shipping information — data on seldom-used or very new products — dimensions — and much more is yours for the asking.

CREDIT is easy to arrange with WESCO, if you have a sound financial record. The fact that we have over 60,000 accounts on our books proves that!

EVERYONE wants to buy at the right price. We aren't a cut-price house, but our prices are truly competitive. And if you send us orders without showing prices, we'll automatically bill you at the most favorable discounts, quantity and quality considered.

BRANCHES ON LAST INSERT PAGE

NOW *more than ever* YOU NEED WESCO

WHAT WESCO STOCKS MEAN TO YOU—

Westinghouse Electric Supply Company places special emphasis upon carrying varied and complete stocks of standard products in all its branches. In addition, District headquarters stocks carry many supplementary items which can be drawn on by the branches.

Our catalog gives you data on many of these products. The following pages will give you up-to-date facts on products of many of the leading manufacturers whose materials we regularly stock and sell.

STOCKS for coming Fall activities are ready for you at each of our 77 houses. In many types of supplies we buy from two or more manufacturers, thereby giving you the choice of more than one source of supply. And if you are a regular user of some non-standard item, we'll gladly keep a reserve stock on hand for you.

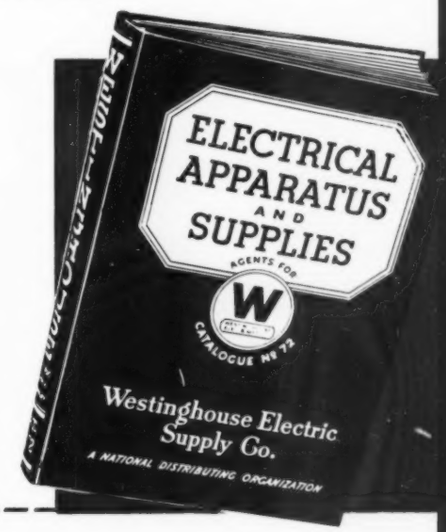
TIME means money these days. You can't afford to wait for material. We are geared to just such operating conditions. If our ample stocks do not include just what you want, we can get it for you in a hurry. We are in almost daily touch with manufacturers by phone or telegraph and can clear your special orders with maximum speed.

OPERATING conditions on many jobs require careful scheduling of material deliveries. We hold closely to these schedules, bringing goods into our warehouses well ahead of time if necessary, to be sure that deliveries will be made as you call for them.

COURTESY and consideration are accorded every order — large or small — at WESCO. Your interests are of first importance to every WESCO employee.

KNOWLEDGE of the electrical distribution and jobbing business is a primary requirement of every WESCO employee. Most of our people have come up "through the ranks" and are therefore better able to give you capable, prompt service.

STRENGTH of our buying power is your strength too. We are the largest customer of many manufacturers — which means that we get the best prices and the best deliveries. You'll profit by joining forces with WESCO.



Westinghouse

Electric Supply Company

A National Distributing Organization With 77 Branches

WESTINGHOUSE ELECTRIC SUPPLY COMPANY
150 Varick Street, New York City

☐ Please send me a copy of your catalog No. 72.

☐ Have a representative call.

Name _____

Company _____

Address _____

City _____ State _____

BI-METAL

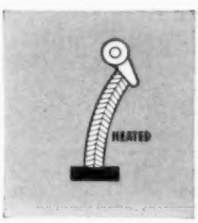
SEE HOW
HEAT BENDS BI-METAL

Ask Your Westinghouse Representative For This Bi-Metal Demonstration

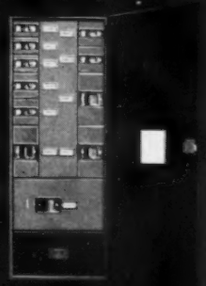
Make This Test Yourself... A strip of Bi-Metal and a match are all you need to prove to yourself the time and money-saving advantages of Bi-Metal Protection. Ask your Westinghouse Representative for Bi-Metal Demonstration Kit.

HERE'S HOW BI-METAL SAVES MONEY ... GIVES BETTER PROTECTION

Two different metals bonded together, when heated always bend in the same direction. The heat from short circuit or continued overload currents causes the Bi-Metal, which is exactly calibrated to the job at the factory, to act and open the circuit. Because of Bi-Metal's characteristics, its accuracy never changes, regardless of the number of operations. There's nothing to replace ... nothing to wear out.



YOU PAY NO MORE FOR BI-METAL PROTECTION IN THIS WESTINGHOUSE EQUIPMENT



SERVICE

Distributed by **WESTINGHOUSE ELECTRIC SUPPLY CO.** BRANCHES ON LAST INSERT PAGE

STOCKS

NOW *more than ever* YOU NEED WESCO

GIVES MOST ACCURATE PROTECTION

ORIGINAL CALIBRATION UNCHANGED BY REPEATED OPERATION OF THIS MANUAL STARTER

To get dependable, consistent motor overload protection, be sure you get Bi-Metal protection in your motor starter.

The Bi-Metal relay is accurately calibrated at the factory. It maintains this accuracy unchanged even after repeated operation. Before the heat of an unsafe overload can damage motor windings, the Bi-Metal operates automatically to disconnect the motor from the line. There is nothing to renew or replace. You save time, trouble and money.

PLUS THESE MONEYSAVING FEATURES

Indicating handle shows clearly whether starter is "on," "off," or "tripped." Safety interlock prevents accidental contact with live parts. Double break silver contacts give quick-make, quick-break.

"DE-ION" ARC QUENCHERS AT NO EXTRA COST

Westinghouse "De-ion" arc quenchers confine, divide and extinguish the arc instantly . . . prevents burning of contacts.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

"DE-ION" MOTOR WATCHMAN

SERVICE

Distributed by **WESTINGHOUSE ELECTRIC SUPPLY CO.** BRANCHES ON LAST INSERT PAGE

STOCKS

NOW *more than ever* YOU NEED WESCO

C·S·P TRANSFORMER *gives you* "EASY CHAIR" LOAD SURVEY

SIGNAL LIGHT—Gives instant warning when an overloaded condition exists in the transformer—providing free load survey.

BREAKER—Operates only when overload reaches dangerous proportions. Permits temporary overloads without interrupting service.

C·S·P

IS THE ONLY TRANSFORMER PROVED BY LIGHTNING

As a final test, every C-S-P Transformer is given a lightning stroke—800,000 volts and 65,000 surge amperes—your assurance of a transformer that will stay in service.

C-S-P has a record of 99.66% PERFECT PERFORMANCE in the service of almost a thousand power companies.

SIGNAL LIGHT SAYS "WATCH"

The instant there is an overloaded condition on any C-S-P, the signal light comes on to say, "This transformer is doing too much work." If the overload is relieved, light can be reset without interrupting service. Should the overload reach dangerous proportions, the built-in breaker opens the circuit—protecting the transformer.

BREAKER HALTS OVERLOAD DAMAGES

Here is, in effect, a free load survey, plus 24-hour-a-day overload protection. The transformer cannot burn out—the breaker won't permit that.

Many power companies are saving money every year by using this form of load survey, which is safe, sure and positive. It not only avoids the cost of periodic load surveys, but prevents unnecessary transformer changes and assures maximum use of transformer capacity. It also protects against service interruptions that mean customer dissatisfaction.

PLUS THESE C·S·P ADVANTAGES

The C-S-P Distribution Transformer is the only one that provides:

1. Complete self-protection against service interruptions from fuse outages.
2. Complete self-protection against lightning.
3. Complete self-protection against burnouts from short circuits.
4. Complete self-protection against burnouts from overload.
5. PLUS, simplified installation, low cost construction, and lower maintenance cost, for every year of service.

Ask any Westinghouse man to give you complete details.

J-70239

SERVICE

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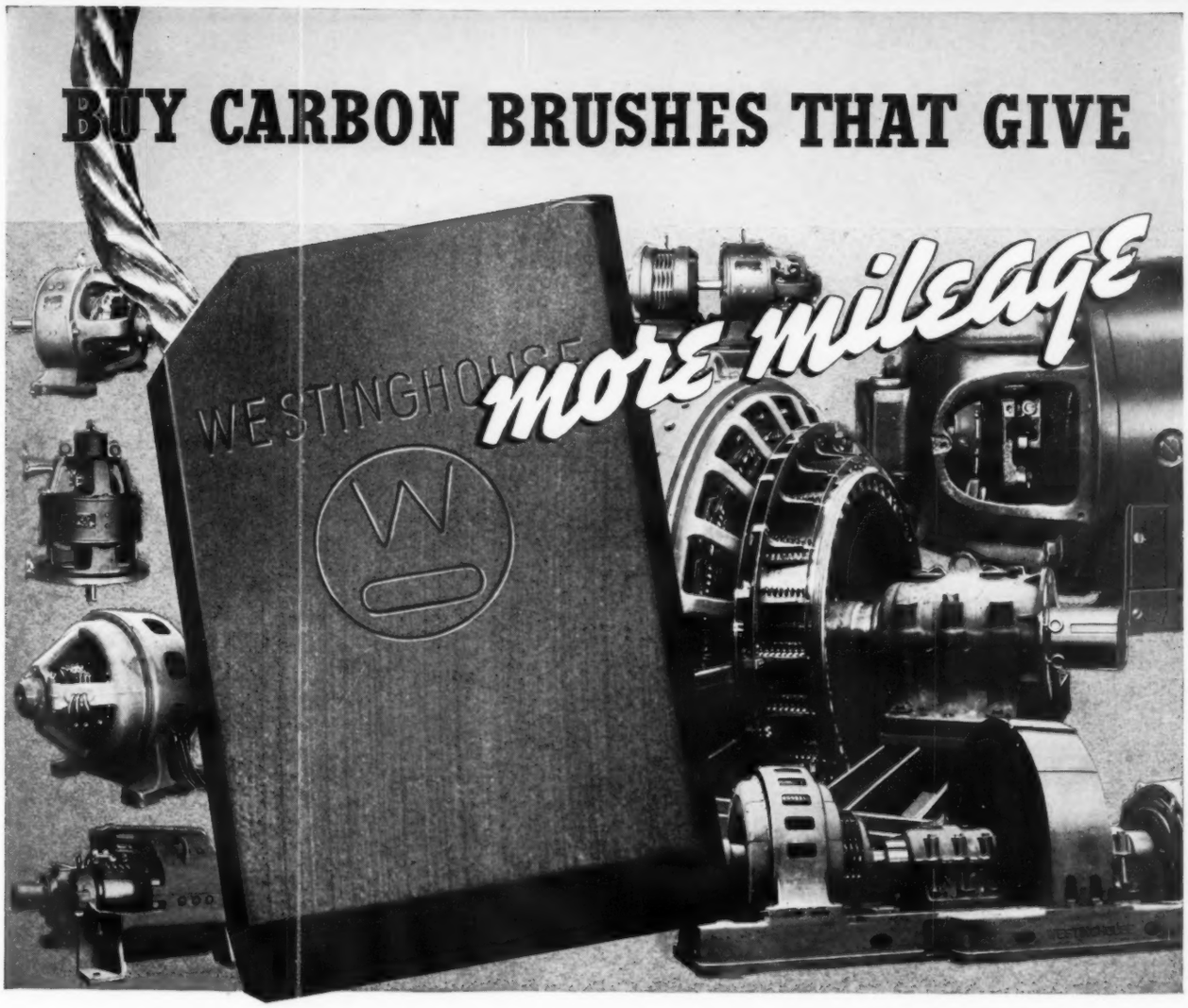
STOCKS

NOW *more than ever* YOU NEED WESCO

BUY CARBON BRUSHES THAT GIVE *more mileage*



IRON OUT BRUSH PROBLEMS THIS PRACTICAL WAY

From long experience and leadership in the design and manufacture of improved electrical equipment, Westinghouse is exceptionally well equipped to aid you in solving your carbon brush problems.

First of all, coordination in Westinghouse design and application of brushes through the combined efforts of experienced machinery designers and brush engineers has resulted in superior grades for every type of use. Then, to help you analyze your requirements, Westinghouse is in position to supply the service of both machine and brush engineers to arrive at a solution to your commutation problems. You will find that a Westinghouse brush survey, followed by the use of the grades as specified by Westinghouse will result in improved commutation, more efficient machine operation and lower maintenance costs.

Once the proper grade has been specified by Westinghouse for any particular use, your brush ordering and inventory problems will be simplified by the Westinghouse system of style numbering, and you will be perfectly safe in ordering a quantity of this particular grade for your stock.

There is a Westinghouse representative nearby. It will pay you to call him in.

J 91315

W WESTINGHOUSE ELECTRIC

Westinghouse

THE NAME THAT MEANS EVERYTHING IN ELECTRICITY

SERVICE

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STOCKS

NOW *more than ever* YOU NEED WESCO

Thumbs up!

New Westinghouse Push Buttons...save space... stop fumbling ...improve appearance!

It's a unanimous "thumbs up" sign of approval that machine operators give the new Westinghouse Type SD push button.

Its large buttons are easier to operate . . . its shrouded design and optional safety latch protect machine and operator from accidental operation . . . and its compact, modern design is tops in appearance!

For any control circuit application . . . for any type of mounting . . . you'll be interested in the added convenience and appearance that Type SD push buttons offer. Write for the new bulletin describing them—bulletin 15-020.

ROTARY SELECTOR SWITCHES

Rotary selector switches provide an optional type of control station with the same modern lines and appearance as the new Westinghouse push buttons.

ENCLOSURES FOR EXPOSED LOCATIONS

Dust and watertight enclosures, where desired, make Type SD push button units available for outdoor or exposed locations.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Dept. 7-N.

J-20883

Westinghouse *Type SD* Push Buttons

W WESTINGHOUSE ELECTRIC

SERVICE

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STOCKS

NOW *more than ever* YOU NEED WESCO

FLUORESCENT *Lighting*

There's a big increase in amount of light here, but no sign of glare or deep shadows on the work. Fluorescent Daylight is so natural, so cool, so comfortable, it easily steps up efficiency. No more time out for eyestrain headaches.

MUST BE GOOD!

As the saying goes, "it must be good to have got where it is!" Yes, Fluorescent lighting is going into more factories, stores, restaurants, theatres and showrooms every day. It gives new *quantities* of light needed at low operating cost. More important, Fluorescent gives entirely new *qualities* of light never before obtainable.

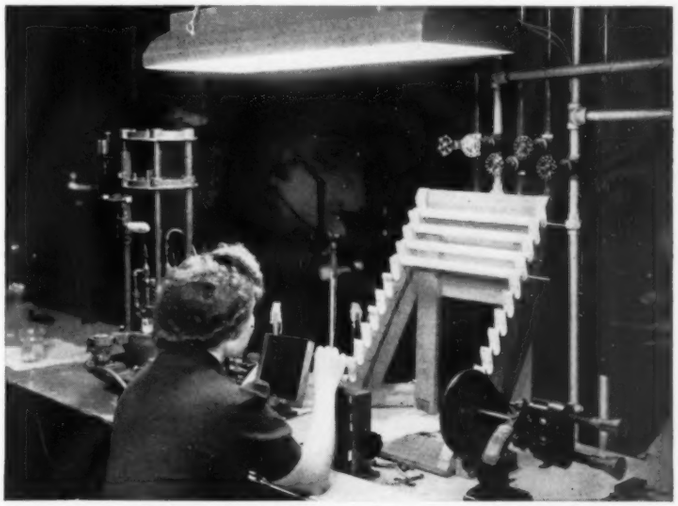
It's cool. It's amazingly glare-free. It's available in "daylight" and rich new colors. This light of the future comes today in ready-made "packages" for you to install easily and quickly. Or you can tailor it to any requirement of special architectural, decorative and lighting plans.

MUST BE RIGHT

To attain the full benefits of Fluorescent lighting, to assure every advantage your customer expects, be sure of the equipment you install. And make certain that all Fluorescent fixtures you install are Westinghouse Lamped. Westinghouse MAZDA "F" Lamps are designed to produce the *maximum* results expected from *approved* Fluorescent fixtures and controls. Write for FREE BOOKLET on Application of Fluorescent Lighting. Westinghouse Lamp Division, 150 Broadway, New York.

THESE SEALS OF APPROVAL

RLM are further safeguards of quality on luminaires, fittings and fixtures for MAZDA "F" Lamps.



Here at a Westinghouse Lamp Division plant, standards of quality and precision are rigidly maintained. Mazda "F" Lamps must pass many inspections for a final OK. Fluorescent lighting itself is now used for inspection.

Westinghouse
FLUORESCENT LIGHTING

W Westinghouse MAZDA LAMPS

SERVICE

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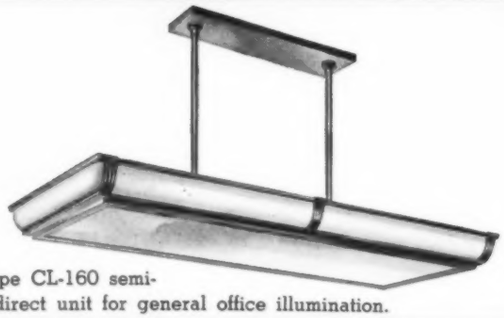
STOCKS

NOW *more than ever* YOU NEED WESCO

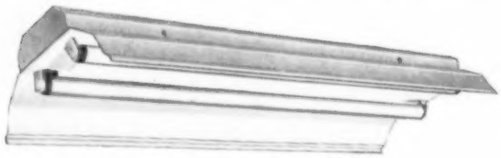
HEADQUARTERS for FLUORESCENT LIGHTING

by Westinghouse



Type CL-160 semi-indirect unit for general office illumination.

Type 2CL-40 surface mounting Continuous Strip unit.



Type FPC 2-lamp fixture with square end for continuous strip lighting of assembly and production lines.

Type FPR Luminaire with open end and porcelain enameled reflector.

2-lamp Type FP RLM enameled unit, approved by RLM Standards Institute for industrial lighting.

Complete Fixture Line Includes Commercial and Industrial Units

Westinghouse offers a complete line of carefully-engineered, ruggedly constructed Fluorescent luminaires for industrial plants and offices. These fixtures are 50% cooler . . . and give twice as much light without glare or shadow. Either single units or continuous strip lighting for commercial and industrial applications are available. Standard Westinghouse ballasts provide high power factor and minimized cyclic flicker. All Westinghouse Fluorescent luminaires are easy to install and economical to maintain.

Your nearest Westinghouse Electric Supply Company office has complete stocks and application information on the entire line of Westinghouse Fluorescent lighting equipment. A WESCO Lighting Specialist will gladly work with you in preparing special layouts and estimates. Call WESCO today and get the complete story of Westinghouse Fluorescent quality and Westinghouse engineering services. Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland.

Tune in "Musical Americana," N.B.C. Red Network, Coast-to-Coast, every Thursday evening.

Westinghouse Lighting Equipment

SERVICE

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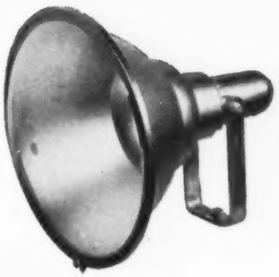
NOW *more than ever* YOU NEED WESCO

HEADQUARTERS

for PROTECTIVE Floodlighting

by Westinghouse

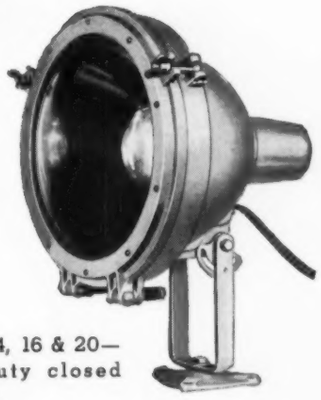


A-14, 16 & 20—Closed units for yards and buildings.

AF & AFA-16 & 20—Open type, porcelain enameled units.

VHR—Closed unit for building and yard use.

A-8 and A-10—Lightweight units for emergency use.



CAK-12, 14, 16 & 20—Heavy-duty closed floodlights.

Quality-Proved Floodlights Geared to Defense Requirements

Today American Industry has urgent need for *adequate Protective Floodlighting* . . . night-time insurance against sabotage and wanton vandalism.

And today you can supply your industrial customers with the best in Protective Floodlighting equipment and the soundest of application engineering—through your nearest Westinghouse Electric Supply Company. Complete floodlighting stocks are available to meet the most rigid national defense requirements. If your industrial customer already has floodlighting, Westinghouse will help you check its maximum effectiveness and protection. If new lighting is planned, be sure to ask WESCO for a layout that will assure *protection of property, persons and production.*

WESCO is LIGHTING HEADQUARTERS for all types of Floodlighting . . . for Industrial Protection . . . Sportsfields . . . Decoration . . . and Swimming Pools. Call your nearest WESCO Lighting Specialist today, or write Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

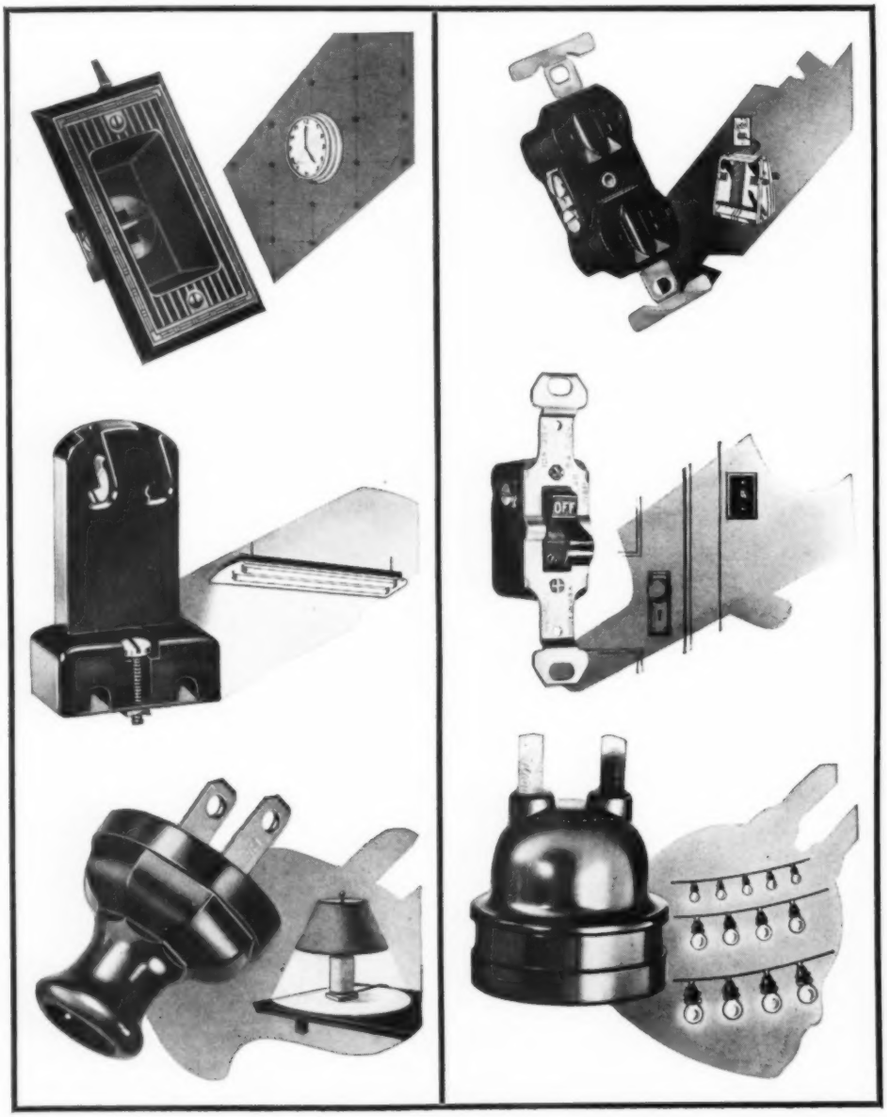
Tune in "Musical Americana," N. B. C. Red Network, Coast-to-Coast, every Thursday evening.

Westinghouse Lighting Equipment

Distributed by **WESTINGHOUSE ELECTRIC SUPPLY CO.** BRANCHES ON LAST INSERT PAGE

NOW *more than ever* YOU NEED WESCO

Prepared TO SERVE YOU BEST



Quality materials and workmanship are important factors in any program of preparedness. It is only through these factors that dependable performance in time of need can be assured. The Bryant line of superior wiring devices meet requirements of quality and workmanship with an enviable reputation for standing up on the job.

Service is an equally important consideration for preparedness, because availability of stocks is essential. The extensive facilities of Westinghouse Electric Supply Company assure you prompt delivery from plentiful stocks close at hand.

This combination of preparedness in both wiring devices and service presents a greater performance opportunity to you.

BRYANT

SUPERIOR WIRING DEVICES

THE BRYANT ELECTRIC COMPANY • Bridgeport, Connecticut

"Every Outlet Deserves a Bryant Device"

Since 1901 *a subsidiary of* **WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY**

SERVICE

Distributed by **WESTINGHOUSE ELECTRIC SUPPLY CO.** BRANCHES ON LAST INSERT PAGE

STOCKS

NOW *more than ever* YOU NEED WESCO

VARNISHED CAMBRIC CABLE · RUBBER POWER CABLES · BUILDING WIRE

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

ARMORED CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · SIGNAL CABLE

Get Your Quota

in the Profitable Rewiring Market *with*

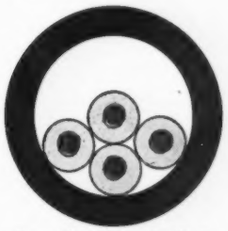
CRESCENT

Small Diameter Building Wire

As you well know, the changes in the new National Electrical Code open up great profit opportunities for you in the rewiring of existing "bottle-neck" branch circuits with attendant increases in feeders—to say nothing of sales in fixtures and appliances.

For such rewiring, it will pay you to use CRESCENT ENDURITE Rubber Insulated Type RHT and CRESCENT SYNTHOL Synthetic Insulated Type SN SMALL DIAMETER BUILDING WIRES which are unexcelled in quality, ease of installation and permanence.

Two typical examples of the increase in capacity possible in existing ½" conduit are shown in the lower two figures at the right.



Four #14 Type R Code Wires permit 3450 Watts

Six #14 Type RHT Small Diameter Wires permit 6075 Watts

Six #12 Type SN Small Diameter Synthol Wires permit 6345 Watts

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

Distributed by **WESTINGHOUSE ELECTRIC SUPPLY CO.** *BRANCHES ON LAST INSERT PAGE*

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It's easy to find your m

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NOW—A METHOD FOR MAKING BENDS WITH GREATER ACCURACY AND EASE THAN EVER BEFORE POSSIBLE—To enable you to use "Inch-Marked" ELECTRUNITE STEELTUBES to best advantage, a new ELECTRUNITE Bender has been designed. It is a one-piece casting with no moving parts to get out of order. Simple instructions are built into the side of the bender. With it any standard type or radius bend can be made more accurately, quicker, with less effort and with less flattening than ever before possible. Complete bending instructions and diagrams are provided on a new bending tag accompanying each bundle of "Inch-Marked" ELECTRUNITE STEELTUBES.

UNDERWRITE
ELEC
STE
ELECTRIC

Look for this
and the "inch-
genuine ELEC

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mark- AND KEEP IT WHEN YOU USE "INCH-MARKED" ELECTRUNITE Steeltubes

It's a simple matter to make true stubs, back-to-back, offset or saddle bends — or to cut accurate short lengths of conduit — when you use "Inch-Marked" ELECTRUNITE STEELTUBES — the electrical metallic tubing with a continuous foot-rule on every length.

"Inch-Marked" ELECTRUNITE STEELTUBES is exactly what its name suggests — tubing clearly marked off on one side in inches. Your mark for bending or cutting already is made for you—and made accurately. It's easy to find by counting off the required feet and inches. And its easy to keep when making the cut or bend. You never need to measure the tubing — in fact, you can use it as a foot-rule. And you can prefabricate bends that always fit from the job blueprint.

"Inch-Marking"— an exclusive ELECTRUNITE feature—makes work on the job easier—insures accuracy in bending and cutting — reduces chance for error — eliminates need for guesswork — saves material.

Try "Inch-Marked" ELECTRUNITE STEELTUBES on your next wiring job. Learn how it can help you — and you'll continue to use it. Steel and Tubes Division, Republic Steel Corporation, Cleveland, O.

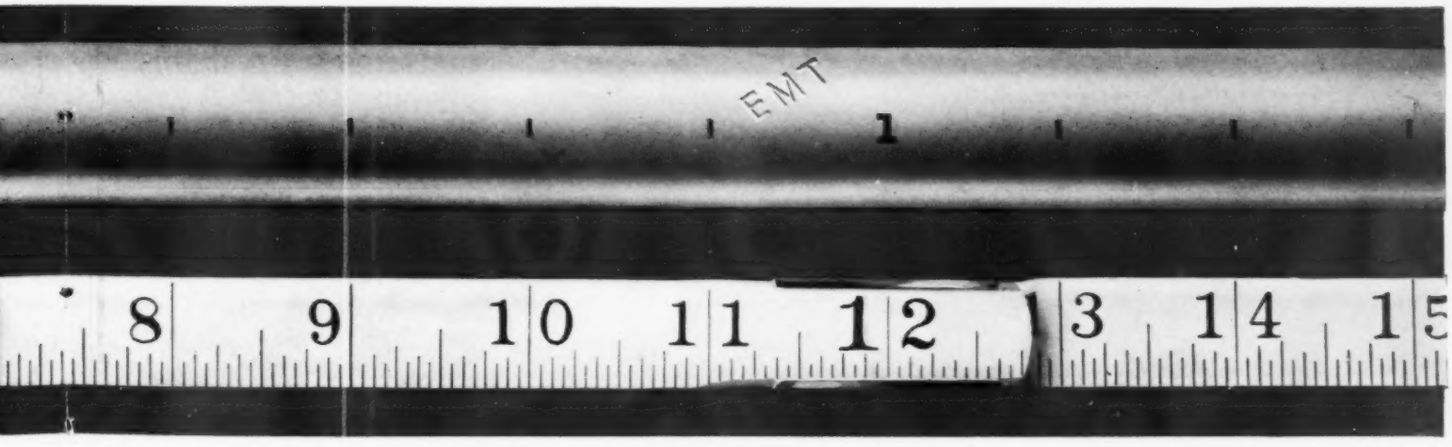
UNDERWRITERS' LABORATORIES, INC. INSPECTED RIGID ELECTRUNITE REG. U.S. PAT. OFF. STEELTUBES 2-48 ELECTRICAL METALLIC TUBING

k for this new red and black label l the "inch-marking." They identify uine ELECTRUNITE STEELTUBES.

SEE YOUR LOCAL ELECTRUNITE DISTRIBUTOR

In addition to being the exclusive distributor for "Inch-Marked" ELECTRUNITE STEELTUBES, he stocks a complete line of dependable electrical supplies. He is equipped to give you prompt delivery— and he can be of valuable assistance in estimating and in helping you to keep jobs moving on schedule.

REG. U. S. PAT. OFF. REPUBLIC STEEL



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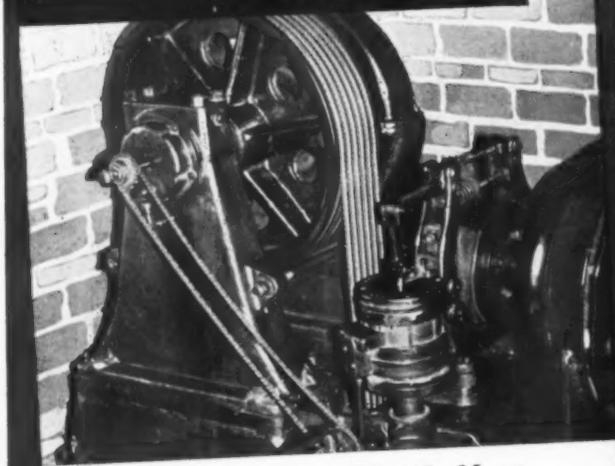
These FUSE USERS Once Suffered from USELESS SHUTDOWNS – but

Read what they say NOW!

"OUR ELEVATOR CIRCUITS WERE A CONSTANT SOURCE OF TROUBLE . . . *until we installed* BUSS FUSES.

. . . Now, I hardly know I have the fuses in the house."

Chief Engineer, A. Myers
Alexander Hotel, Hagerstown, Md.



Here's the story as related by Mr. Myers

"The 200 ampere fuses protecting our elevator were a constant source of trouble, blowing on an average of 10 times a month.

"About five years ago I installed BUSS Super-Lag fuses of the same amperage. Since then I don't recall having as many as one blow per year—in fact I hardly know I have fuses in the house."

"WE RID OURSELVES OF NEEDLESS SHUTDOWNS—and DESTRUCTIVE HEATING IN SWITCHES by INSTALLING BUSS Super-Lag FUSES"

Says, Jacob Kovalchek, Chief Electrician Gibbons Ale & Beer, Wilkes-Barre, Pa.

"Heavy starting loads on our 150 h.p. motors were causing frequent blowing of 400 ampere 600 volt fuses protecting the line. Another constant source of irritation was excessive heating in the switch which resulted in spring tension being taken out of clips and fuse cases being destroyed by charring.

"During May, 1939, we installed 400 ampere BUSS Super-Lag Fuses. Since that time we have not had a single blow due to heavy starting and there has not been a sign of heating in either the fuses or the clips."

DON'T LET OTHERS GET THE JUMP ON YOU WHEN IT COMES TO MONEY SAVING IDEAS

If needless blows are causing shutdowns in your plant, why not be the first to recognize the service BUSS Super-Lag fuses can render you?

As so clearly shown users of BUSS fuses enjoy a freedom from costly interruptions of electrical service that are so often a burden upon the shoulders of the executives in charge of production or maintenance.

So why not pass the word along that from now on all fuses installed are to be BUSS Super-Lag fuses?

"SHUTDOWNS ON OUR PLANER CAUSED PRODUCTION 'HEADACHES'

. . . until we solved the problem by installing BUSS Fuses"

Says A. Robinson of Taylor Wharton Iron & Steel Co., Highbridge, N. J., "We have a planer driven by a DC motor that formerly was protected by a 50 amp. breaker. Rough spots on castings caused a momentary overload on planer and the resulting surge on the motor circuit frequently caused the breaker to open.

"These recurring shutdowns were a 'headache' as they interrupted production and disrupted shop routine. Several months ago we decided to replace breaker with BUSS Super-Lag Fuses. To date we have had only one blow. We think this phenomenal, as we are getting safe protection plus elimination of needless shutdowns."

BUSS super-lag FUSES

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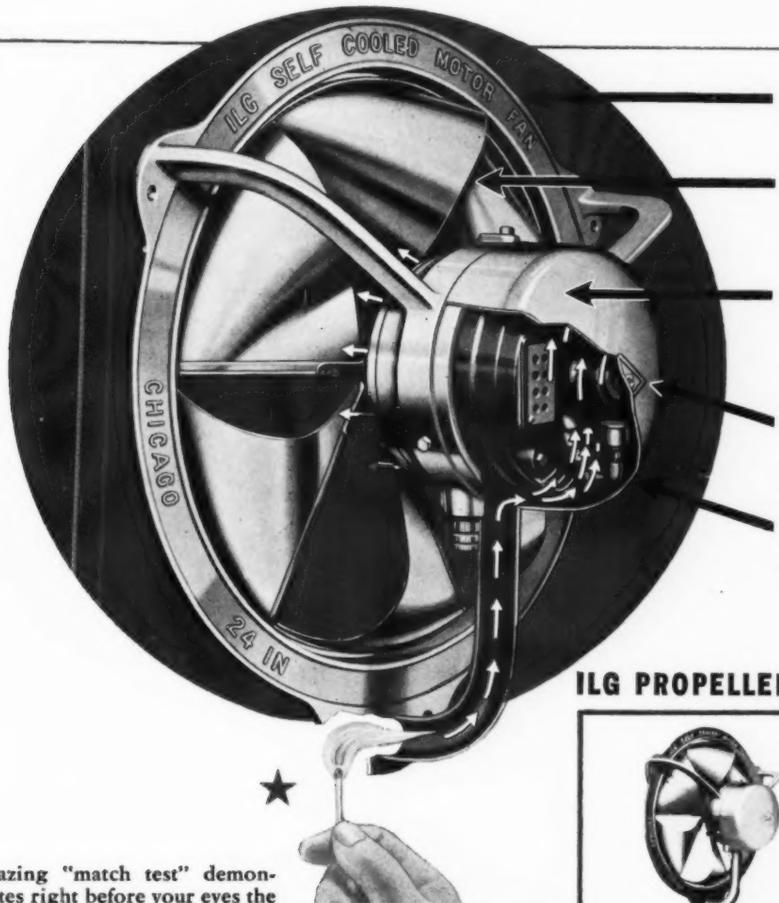
A MATCH WILL TELL THE STORY OF THE *Miracle Motor* THAT *Breathes*



RUGGED, HEAVY-DUTY FRAME WORK—precision-built for long years of continuous service.

DYNAMICALLY BALANCED FAN WHEEL—deeply cupped blades scoop up the air at slow speeds. So accurately balanced, allowance is even made for the paint!

SUPREMELY QUIET—smooth, effortless operation . . . minimum vibration and bearing wear . . . reduced maintenance and operating cost . . . longer life for each unit.

ONE-NAME-PLATE GUARANTEE—every part of ILG Units, *including the motor,* is designed, built and guaranteed by ILG. Undivided responsibility! Simplified service! Guaranteed satisfaction!

SELF-COOLED MOTOR—constantly cooled by fresh, clean air, circulating internally — never reached by foul air. Saves 5 to 10% on power costs — adds to long life of entire unit.

Amazing "match test" demonstrates right before your eyes the human, life-like action of this exclusive ILG Miracle Motor that actually "breathes". As illustrated, air is drawn up through vent pipe, circulated through motor, then expelled from front of motor. ALL the protection of a completely enclosed motor . . . ALL the operating economy of an open motor!

Every item in the comprehensive ILG line—unit heaters and coolers, blowers, propeller fans for office and factory, home cooling fans, kitchen ventilating fans—is now fully illustrated and described in a special new condensed catalog No. C-53. Write today!

ILG ELECTRIC VENTILATING CO.
2879 N. CRAWFORD AVENUE, CHICAGO, ILL.
Offices in 42 Principal Cities

ILG
*Vitalized** **VENTILATION**
AND AIR CONDITIONING
**AIR CHANGE...NOT JUST AIR MOVEMENT!*

ILG PROPELLER FANS FOR OFFICE AND PLANT

ILG COMPACT DIRECT-CONNECTED BLOWERS

ILG UNIT HEATERS WITH 2-PIECE HEADERS

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AT INDUSTRY'S COMMAND...

GENERAL CABLE

BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

Anticipating the greater production that is sure to come with industrial preparedness, it is assuring to know that General Cable is already prepared to meet the increasing demand for quality wires and cables.

General Cable Corporation Sales Offices: ATLANTA · BOSTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · DALLAS · DETROIT
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NOW *more than ever* YOU NEED WESCO

PREPARE FOR ANY EMERGENCY

....with an "EVEREADY" industrial flashlight

"Eveready" General Purpose Industrial Flashlight. 2-cell size No. 1251.

◀ "Eveready" General Purpose Industrial Flashlight. 3-cell size No. 1351.

"Eveready" Safety Type Industrial Flashlight. 2-cell size No. 1259.

"Eveready" Safety Type Industrial Flashlight. 3-cell size No. 1359. ▶

1. Die cast reflectors.

2. All switches replaceable by hand without tools.

3. Simple design for easy carrying. No sharp corners to catch on clothing.

4. Both Industrial and Safety lights have ring hanger bottom-caps.

5. Extra lamp bottom-cap with spare bulb. (On Safety flashlights Nos. 1259 and 1359 only.)

PERMISSIBLE
ELECTRIC FLASHLIGHT
APPROVAL No 605
Approved for Safety in Methane and Air Mixtures
UNDERWRITERS LABORATORIES, INC. INSPECTED FLASHLIGHT FOR USE IN GAS AIR MIXTURES OF CLASS 1 GROUP D INCLUDING NATURAL GAS, LACQUER SOLVENTS, ACETONE, ALCOHOLS, NAPHTHA, GASOLINE AND PETROLEUM
SERIAL NO
NATIONAL CARBON CO. INC.
NEW YORK, N.Y.

"Eveready" Safety Type Industrial Flashlights Nos. 1259 and 1359 are approved by Bureau of Mines and Underwriters' Laboratories for use in certain explosive gaseous atmospheres.

THESE four new "Eveready" Flashlights have been "made to order"—for the man on the job who needs a sturdy, portable light he can *depend on!*

The big new advantage of these lights—the feature that has made a great hit with users—is *automatic focusing*. They never require adjustment by hand. Through the use of a prefocused lamp and a special die cast reflector, the filament is micrometrically located, thus providing a clear, sharp, evenly diffused spot of high intensity. No fuss, no bother, no twisting or turning. You flip the switch—and the light does the rest!

They're tough, too . . . built to take a beating. The outer covering is heavy, semi-hard rubber, reinforced internally with brass parts. This cover has excellent insulating qualities, and is highly resistant to water, oil, greases, gasoline, alcohol and acids.

Easily the finest industrial flashlights ever developed, these products are designed to "do a job" for the man on the job—and save *you* money in the bargain!

The word "Eveready" is a registered trade mark of National Carbon Company, Inc.

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SPEED
YOUR "HURRY-UP" JOBS . . . WITH
BERMICO FIBRE CONDUIT

Today, with time more valuable than ever before, it's best to use Bermico Fibre Conduit. This proven time-saver will speed your "hurry-up" jobs . . . thereby protecting your profit margin. Bermico's natural light weight makes handling easy, facilitates laying-up in the trench. Special Bermico non-split coupling eliminates time losses incurred in replacing broken couplings. Large inventories at WESCO branches throughout the country insure prompt service at all points. Remember that Bermico Fibre Conduit meets all United States government specifications . . . an important factor at this time. Use Bermico Fibre Conduit on your next job. It's the profitable thing to do. Brown Company, 500 Fifth Avenue, New York, N. Y.

NEW BERMICO TYPE II

For installation without concrete encasement. Sturdy, durable. Meets Federal specifications W-C-581 Type II.

BERMICO* *fibre* CONDUIT

A durable protective raceway for underground cables. Easy to install. High mechanical strength. Low water absorption. Acid resistant.

MADE WITH VIRGIN WOOD FIBRE.

* REG. TRADE MARK

A CELLULOSE PRODUCT OF BROWN COMPANY

QUALITY

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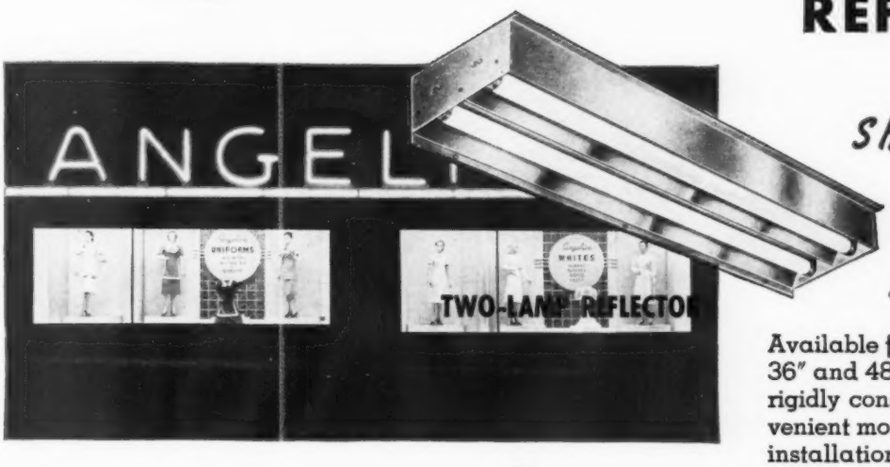
FLUORESCENT LIGHTING

DayBrite SHOW WINDOW REFLECTORS



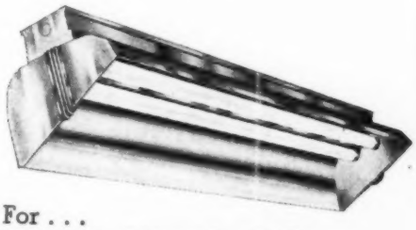
For Show Windows of Every Description

Available for two, three and four 18", 24", 36" and 48" fluorescent lamps. Bodies are rigidly constructed of steel and have convenient mounting holes and knockouts for installation and electrical connections. Specular Alzak reflectors, correctly engineered for most efficient lighting, provide maximum illumination in the correct proportions throughout the entire window.

Complete, Ready to Install

Furnished complete with sockets, ballasts, lamp starters and wire lead — ready for installation. Starting compensators furnished with all fixtures for 36" and 48" lamps using Tulamp ballasts.

Complete wired units with Specular Alzak reflectors for use in smaller window installations. Furnished wired with Tulamp ballasts—ready for installation.



For . . .
18", 24", 36" and 48" Lamps

Day-Brite Lighting, Inc.
5431 Bulwer Ave., St. Louis, Mo.

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Why bother with a *Truckful* when a *Handful* will do all the jobs?

THIS IS NEWS to many Contractors: You can lug, tap and splice more than 90% of your wiring jobs with this one line of T & B Pressure (Solderless) Connectors.

These 32 T & B fittings replace literally thousands of conventional types and sizes formerly required on standard, flexible, extra flexible and hemp core cables, also on rod and tubing.

Solderless connectors are on the way out. T & B are helping to speed their exit by replacing the need for solder with engineered **leverage pressures** — pressures that defy all man-made vibrations, peaceful or hell-raising.

These T & B Pressure Connectors are **installed fast and stay fast.** They are approved by the Underwriters.

Stocked and sold by Westinghouse and other T & B Distributors who are protected by The T & B Plan which assures a 100% Distributor and One-Price Policy to all.

Samples gladly mailed, free on request.

THE THOMAS & BETTS CO., INC.

Manufacturers of Electrical Fittings, of which T & B Pressure (Solderless) Connectors are but one line.

ELIZABETH, N. J.

T&B

A small "PREPAREDNESS INVESTMENT" brings you these 32 T & B PRESSURE (Solderless) Connectors. An ideal set-up for all emergencies. See your T & B Distributor.

LOCKTITE LUG

7 take ALL

cable sizes #4 to 1,000,000 CM.

LOCKTITE TAP

6 tap ALL

mains 1/0 to 500,000 CM to all branches #2 to 500,000 CM.

HINJON JUNIOR

12 tap ALL

mains #8 to 1,000,000 CM to all branches #14 to #1. Solid or stranded.

LOCKTITE 2-WAY

7 make ALL

splices #4 to 1,000,000 CM.

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AND THE GREATEST OF THESE IS MEN

Buckeye Conduit is a combination of fine materials, excellent production equipment, and highly skilled men. And the greatest of these is men!

Anybody can buy machinery and materials but the skill in a man's hands must be built by years of the most painstaking effort -- an effort that must be continuous, untiring, and inspired by ambition and loyalty.

That this is the stuff of which Youngstown's steel makers are made has been recognized by many of our steel mill visitors, who never cease to marvel at the obvious spirit of cooperation that inspires this force. We in the sales department know of it, of course, which is one very important reason why we are proud to offer you Youngstown Buckeye Conduit as a product that is perfectly fitted to your needs.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

Ask your distributor for Youngstown Conduit - Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods - Wire - Nails - Tie Plates and Spikes

26-15C

Buckeye Conduit in the new power house, Possum Kingdom Dam, Brazos River, Texas

YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - YOUNGSTOWN, OHIO

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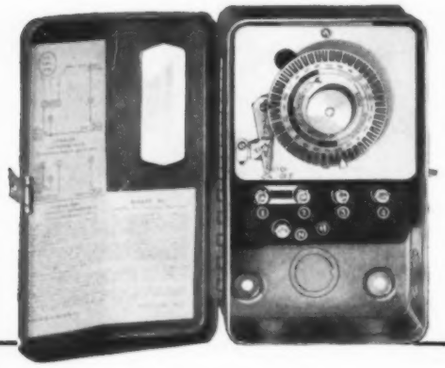
"If it's timed, PARAGON can control it!"



TIME SWITCHES and TIMERS by Paragon to Meet Every Need

The Paragon 300 Series Standard Synchronous Time Switch is a top quality instrument at low cost. The perfect time switch for controlling Signs, Stokers, Store and Window Lights, Fans, Blowers, Pumps, Valves and Motors.

Superior Features

SLOW SPEED MOTOR — **STURDY CLOCK TRAIN**
SNAP-ACTION SWITCH — **SIMPLE HAND TRIP**
MODERN COMPACT CASE — **GUARANTEED TO GIVE SATISFACTORY SERVICE BY PARAGON**

MANUFACTURERS of the largest and most complete line of Time Controls obtainable, including:

TIME SWITCHES

Standard 24 Hour Models • Heavy Duty 24 Hour Models • Program Time Switches • 2 and 3 Circuit Time Switches • Poultry Time Switches.

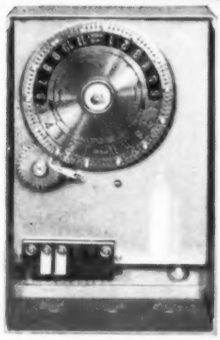
TIMERS

Time Cycle Repeaters • Process Timers • Interval Timers—Manual reset • Contact Repeaters • Time Delay Relays • Automatic Reset Timers • Attic Fan Timers.

PROGRAM CLOCKS

For ringing bells, etc.

STOKER CONTROLS



100 Series One-Day Program Time Switch
Adjustable for operations as close as 15 minutes apart

1200 Series Synchronous Interval Timers
Manual set types for Window lights, Attic fans, etc

700 Series Seven-Day Calander Time Switches
Individual control for each day in the week

PARAGON ELECTRIC COMPANY
37 WEST VAN BUREN ST., CHICAGO, ILLINOIS
Builders of Control Instruments Since 1905
Distributed by
WESTINGHOUSE ELECTRIC SUPPLY COMPANY

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Sherman Electrical Connectors

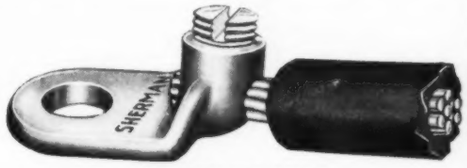
A Complete Line Providing Electrical Efficiency Plus Mechanical Strength

These precision made Sherman electrical items assure connections as strong and efficient as the conductor itself. Every one of these items has been designed with great care. Each is made of the finest materials—on special Sherman machinery that insures uniform dependability, yet permits the volume production necessary to maintain lowest prices.

It pays to specify Sherman Terminal and Wire Connectors. They install easily and quickly—save time—cut costs. And—they are the surest means of making strong, everlasting connections.

H. B. SHERMAN MFG. COMPANY, Battle Creek, Mich.

SOLDERING LUGS
Side formed

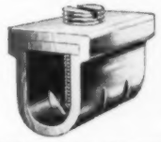


SOLDERLESS LUGS
Type S-M compact and economical

SOLDERING LUGS
Heavy duty

SOLDERLESS LUGS
Type S-O husky and universal in application

CONNECTORS
For ready disconnecting of leads



Wedge Grip Connector

SPLICING SLEEVES

Figure eight

Oval

Split Tinned

Your Westinghouse Branch is equipped to supply you with all types of Sherman Electrical Goods. Specify Sherman products and get superior quality at lowest prices.

FUSE CLIPS
Best spring bronze

SHEET METAL TERMINALS
A design for every purpose

"BONDROD" CLAMPS
One piece construction

LIGHT GROUND CLAMPS
Hard copper—will not stretch

HEAVY DUTY CAST GROUND CLAMPS
For exterior ground connections

BAKELITE FIXTURE CONNECTORS
Mechanical Clamping and fully insulated

BRONZE FIXTURE CONNECTORS
Universal for all wires No. 12 or smaller

SPLIT BOLT CONNECTORS
Available with nut retainer

SET SCREW CONNECTORS
With dividing wall or hole clear through

ARMOR ROD & JUMPER CLAMPS

Approved for use on aluminum, copperweld, amerductor, etc. Made of high-grade bronze

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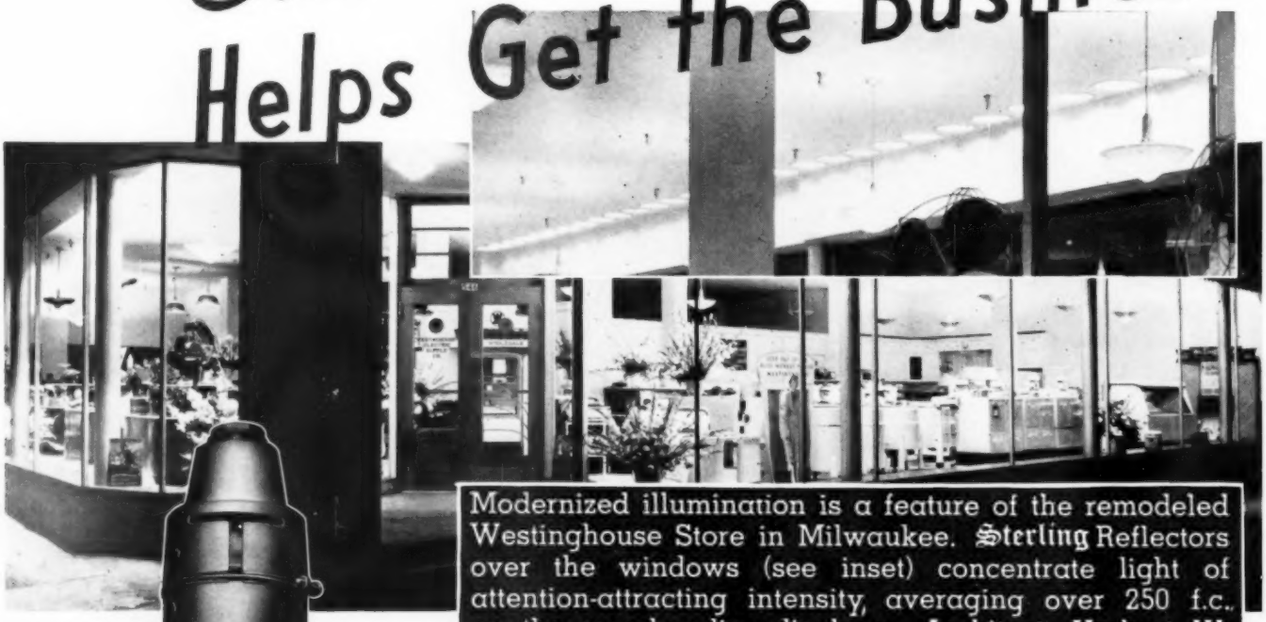
Sterling *Extra Lighting Value* Helps Get the Business



Modernized illumination is a feature of the remodeled Westinghouse Store in Milwaukee. Sterling Reflectors over the windows (see inset) concentrate light of attention-attracting intensity, averaging over 250 f.c., on the merchandise displays. *Architect*—Herbert W. Tullgren. *Electrical* Contractor—Staff Electric Co.

More Sales Punch per Watt! That's the marvelous achievement of Sterling Lite-Flo Reflectors that appeals to merchants and display men.

For Sterling Silvered Glass Reflectors control light with wonderful efficiency—project it direct to the display with minimum waste. Give the effective concentrated illumination display men want with the relatively low wattage merchants appreciate.

You can be sure of one thing—*extra value clicks* with successful merchants.

Large and small Department Stores, Drug and Shoe Stores, Dress and Hat Shops, Haberdashers—all kinds of retail stores *want extra value* from their sales lighting dollars.

That's why so many contractors have found the extra lighting value offered by Sterling Reflectors *gives real contract-closing punch.*

LIGHTING LAYOUT SERVICE

ENDURING LUSTRE — Made in CHICAGO U.S.A. — Sterling — TRADE MARK — SILVER PLATED GLASS — STERLING REFLECTOR CO.

Just send data covering the job for the last word in modern lighting layouts—specially designed for the application — including complete price information and description of recommended equipment.

FREE CATALOG

70 Pages of display lighting suggestions, layout information, illustrations and description of Sterling Reflectors for every requirement. Write for your copy today.

STERLING REFLECTOR CO., 1435 W Hubbard St., CHICAGO

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NOW *more than ever* YOU NEED WESCO

JUST *Off the Press!*

A New Estimating Catalog for Electrical Contractors

A VERITABLE STOREHOUSE OF INFORMATION
ON THE COMPLETE AND UP-TO-DATE LINE OF

STEEL CITY ELECTRICAL SUPPLIES

BUILT FOR QUICK AND EASY REFERENCE

Steel City Electric Company

PITTSBURGH, PENNSYLVANIA

Manufacturers of ELECTRICAL SUPPLIES

MANY NEW ITEMS

Among the many new items listed ar illustrated in this edition are

New Type Hangers for Switch ar Outlet Boxes.

Outside Clamp Boxes.

Screw-adjustment Floor Outlet Boxe

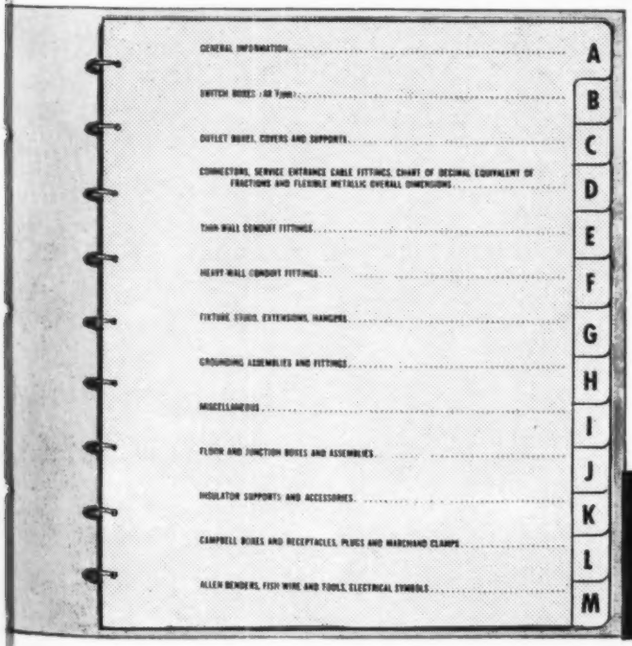
Improved Connectors.

Door Switches for New and Old Wor

Various Types of Insulating Bushing

Cable Heads and Miscellaneo Fittings.

Steel City Engineers are constant studying the problems of the Ele trical Contractor and designing f tings that will make his work easi and more satisfactory.



LOOSE LEAF AND CONVENIENTLY INDEXED

This new catalog has been produced in two forms of binding—Kamket and Accordian—both bindings permit removal and addition of pages.

The catalog contains 13 sections with items grouped and classified for quick and easy reference. Durable dividers carrying numerical indexes separate each section.

The entire catalog has been designed, just as Steel City Products have been designed, to save busy contractors time and trouble.

It Pays to Specify STEEL CITY PRODUCT

Not only is it the aim of the Steel City Electric Co pany to make easier the estimating of electrical wi ing and the ordering of necessary supplies by th electrical contractor, its principal objective is to ho the customer confidence it has built during the pa 40 years by careful workmanship, the use of depen able materials, a policy of rigid inspection and a intelligent understanding of the contractor's problen

When you specify Steel City Products you can l sure that they will be designed to fully meet the particular requirements, enable you to do the jo quicker, better and more economically and that the quality will insure long and satisfactory servic

If you have not as yet received a copy of this new catalog, ask your wholesaler for one or write direct to—

Steel City ELECTRIC CO

1207 COLUMBUS AVE. PITTSBURGH, PENN

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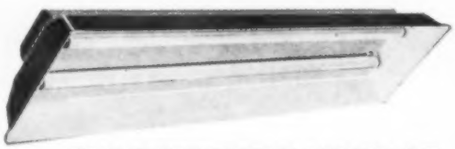
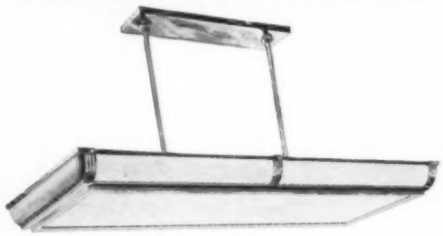
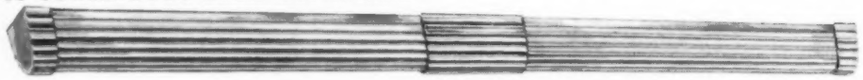


RLM FLUORESCENT LUMINAIRE

CLS-160 FLUORESCENT LUMINAIRE



CL-40 CONTINUOUS STRIP LUMINAIRE



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Westinghouse

ELECTRIC SUPPLY COMPANY

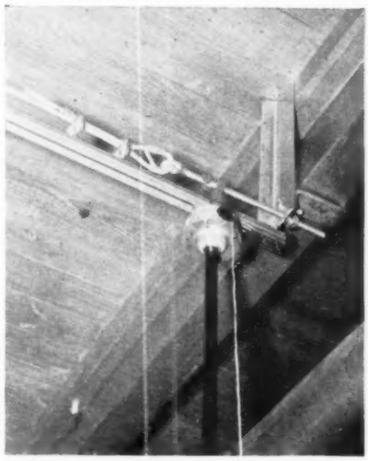
A National Distributing Organization

WIRING Methods

DEAD END CLAMPS

While installing a trolley duct lighting distribution system in a manufacturing plant, the Garden Electric Co., Inc., of Elizabeth, N. J., was confronted with the problem of dead ending the messenger cable on which the duct was mounted.

The glass windows at the sides of the building came up to the steel roof purlin, so there was no steel or brick in which to anchor through bolts. The problem was solved by fabricating dead end clamps of 3-inch channel iron and ½- by 2-inch flat iron bent in the shape of a J clamp with a right angle flange. The J clamp was mounted on the lower flange of the purlin and bolted to the channel iron upright which in turn was fastened to the wood nailer resting on



***FABRICATED CLAMPS** for dead ending the messenger cable supporting the trolley duct installation, were used in this manufacturing plant where building construction prohibited through bolts in the walls.*

the purlin. In addition to keeping the clamp securely in place this channel iron takes the vertical component of the stress applied when the messenger cable is tightened. A hole drilled in the bottom of the channel iron supports an eye bolt through which the ⅜-inch messenger cable is threaded. Two U bolt clamps hold the cable securely. The eye bolt has a long thread to permit tightening the nut to make the messenger taut. These clamps were used on both ends of the messenger cable and were mounted on the steel roof purlins nearest the windows.

CONDUIT CODING

A system of conduit coding is especially helpful on jobs where there are a variety of concrete slab thicknesses and outlet heights are standardized throughout the building.

Such a system was devised and used by M. B. Foster Co. of Boston for a housing project in which they did the electrical work. In this particular case the floor slabs varied in thickness from 4 to 6 inches. Outlet heights were standard for every room. Conduit runs were assembled in groups according to apartments, bundled together, tagged and placed in a pile to await distribution to their respective buildings and apartments. All conduit to go in a specific slab was bent at one time and coded.

The code used for this phase of the work is listed below—

Slab Thickness	*Code Symbol*
6 inches	none
5 inches	0
4½ inches	/
4 inches	⊥

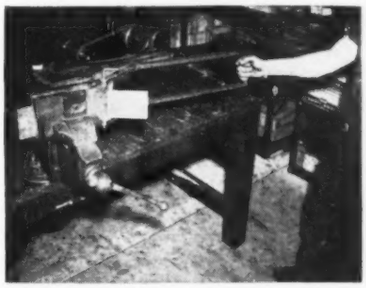
The various circuit runs in each apartment were numbered 1, 2, 3, etc. on the plans. Roman numerals corresponding to these numbers were painted on the assembled conduit section to identify it. This was done as each section was made up. The sections were then grouped together and tagged ready for delivery to the building unit.

Mass production organization, such as this, means saving considerable labor and makes possible competition in low cost housing work. Of course, these principles can be applied to other work.

BUS BAR BENDER

This simple bus bar bender was designed and constructed in the shop of the Electrical Motor Repair Co., Trenton, N. J. Since this company does a considerable amount of electrical construction work in industrial plants, this piece of equipment has long proved its worth.

The bender is made of two solid blocks of steel 1-inch thick and 5-inches high. One block is 9-inches long and the other, which holds the bending lever arm is 10-inches long. The two blocks are mounted to the jaws of an ordinary heavy duty machinists vise. A piece of 1¼-inch by 3/16-inch steel is mounted on the bottom of the longer block to serve as a seat for the copper bus when inserted between the two blocks. The lever arm end of the long block has a rounded edge on its innner side and a tapered rounded outer edge for making smooth 90 degree bends. For bends smaller than 90 degrees the copper is bent around the tapered edge by a continued pull on the lever arm. For this



***BUS BAR BENDER** mounted on a machinists vise and fastened to a portable work bench solves many bus bending problems for this industrial electrical contractor.*

purpose the arm is pivoted at a hole drilled in the long block nearer to the vise jaws.

The lever arm itself consists of four pieces of 1-in. by ⅝-in. flat iron. One 8-inch and one 21-inch piece are welded together at about a 150 degree angle to form one side of the arm. The arm grip is a piece of 1-inch bolt stock. The bending pin is also a piece of 1-inch bolt stock welded between the sides of the lever arm 1½-inches from the pivot point. A long steel pin serves to pivot the arm to the steel block.

This bender will take standard square or rectangular copper bus of any thickness and up to 4-inches in width. With the bending pin resting against the rear block, the bus is inserted between the blocks, the vise tightened and a pull is then applied to the lever arm. The resultant bend is smooth and free of cracks.

ASK FOR G-E WIRE AND CABLE AND G-E CORDS

CORDX and CORDX Jr.

You will obtain excellent lasting service from G-E Building Wires and Cables and from G-E Cords because they are carefully made of the finest raw materials. Quality is uniformly high. All grades of G-E Wire are easy stripping and easy pulling. G-E Cords are flexible and durable. The line includes:

RUBBER-COVERED WIRE AND CABLE

Type	Grade	Insulation	Maximum Operating Temp.
R	Code	Exceeds Underwriters' Requirements	50C
RP	Performance	Contains 30% new rubber	60C
RH	Heat Resistant	Superaging	75C
RW	Moisture Resistant	Use in lieu of leaded cable (See N.E.C.)	50C

SYNTHETIC INSULATED WIRE
(For Rewiring Existing Raceways)

SN. . Synthetic. . Flamenol* Small Diameter Building Wire 60C

ALL-RUBBER CORDS

S. . . CordX. . . . For severe service conditions. Insulation, 30% new rubber. Jacket, 60% new rubber.

SJ. . CordX, Jr. . For use where service conditions are less severe. Insulation, 30% new rubber. Jacket, 40% new rubber.

*Reg. U. S. Pat. Off.

The G-E Cord line includes many other all-rubber cords and braided cords.

GENERAL ELECTRIC ... 12 R 600 V ... CODE GRADE
ELECTRIC ... 12 RP 600 V ... PERFORMANCE GRAD
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For further information see the nearest G-E Merchandise Distributor or write to Section W-0120, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

WIRING Methods

[FROM PAGE 103]

This bender is bolted to a portable work bench which is taken to the job and fastened by U bolts to the steel column nearest the center of work activity.

PREVENTING ELECTRICAL SABOTAGE

Edward J. White, member of the Newark Safety Council and president of E. J. White Co., electrical contractors, Newark, N. J., presents a number of methods which may prove the means of thwarting the work of saboteurs intent upon disrupting the electrical system and hence the production of a manufacturing plant. Mr. White believes these points should be kept in mind by all electrical contractors, plant engineers and electricians in these precarious times.

The list of preventive measures includes:

1. Locate transformers inside buildings. Outdoor transformer mats may be damaged by throwing metallic objects over the open buses or, if near driveways, "accidentally" hitting them with trucks.

2. Keep all panel boxes, switch and control enclosures locked. Use dead front type equipment. Seal all conduit entrances to this equipment. Nitric or sulphuric acid poured into conduit raceways can cause a lot of trouble.

3. Check and drain bearing oil frequently. Use automatic oilers or ball bearings. A small amount of abrasive material mixed with the oil will soon destroy motor or generator bearings.

4. Place all wires in conduits inside of buildings and underground. It's an easy matter to short circuit open wiring, especially if the insulation has begun to deteriorate.

5. Use the proper size tamper-proof fuses or circuit breakers to prevent motor burnouts due to overloads. Intentional overloading of machines and "doctoring" of fuse links may cause serious damage.

6. Keep all dark areas and passageways well lighted to prevent accidents and personal injury. Keep all lamps out of reach and use locking devices.

7. Use lock-type switches or circuit breakers on exhaust fans to insure the removal of any deadly or injurious fumes which may exist as a result of the manufacturing process.

8. Use only experienced electricians to install electrical equipment. Poor workmanship may result in system failures or serious injury to employees.

9. Replace all damaged wiring or obsolete equipment. Damage, shutdowns and production delay may result from its use.

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This way to Orders!

NEW BUILDING to meet industrial shortages . . . plant expansion for rearmament programs . . . this is the way to profitable wiring contracts. And the road to these orders is *lined* by H & H Industrial Devices. Here are typical wiring items for heavy-duty service, power and light:

Left side, first above, Weatherproof Switch, Weatherproof Receptacle. Second, Type C Ceiling Pull Switch. Third, 3-wire Rubber Cord Connector. Fourth, Type C Tumbler Switch.

Right side, first above, Small Motor Starting Switch. Second, 3-wire Receptacle with Rubber Plug. Third, 2-wire 20 Ampere Duplex Receptacle with cord grip Cap. Fourth, 3-wire Flush Receptacle with Cap.

★ ★ ★

Most all new buildings (and modernizations) will be *adequately* wired for maximum production and convenient power connections. Your H & H Line is *more* than adequate; it's the line that leads to the ORDERS.

HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

Estimating

POLE LINE CONSTRUCTION

A part of the electrical contractor's work in the modernization and expansion of an oil and asphalt plant was the construction of a high tension inter-plant overhead power distribution system, with a tie-in to the plant generators and the local utility lines.

The distribution line is approximately 3,500 feet long and weaves in and out of the plant area. The work consisted of setting 16 new creosoted wood poles, ranging from 40- to 50-feet in height, with the necessary cross arms and incidental pole line hardware; 12 pole type disconnect switches; also the lowering of cross arms on 18 present poles. Two sets of double cross arms were necessary for dead ending the lines on five corner poles. The distribution lines consist of new 2300-volt, No. 4/0 and No. 1/0 weather proof wires.

The oil saturated condition of the ground necessitated the use of steel drums, with the ends removed, in the holes. The poles were set in these drums and a transit-mix concrete base poured around them. A small line truck was used to set the poles. A chain block was used to take up the slack on the conductors after they were strung on the cross arms.

An accurate check on the material and labor used was kept by the contractor and the following is the material list and labor breakdown recorded:

Material Installed

1—50-ft. creosoted wood pole
10—45-ft. creosoted wood poles
5—40-ft. creosoted wood poles
80—wood cross arms
250—insulators and pins
160—28-in. flat steel braces
14,000 ft. No. 4/0, 5000-volt weather-proof wire
2,000 ft. No. 1/0, 5000-volt weather-proof wire
1,000 ft. ⅜-in. stranded steel guy wire
16—strain insulators
6—pieces 12-in. by 12-in. creosoted timber, 6-ft. long
6—⅝-in. by 5-ft. steel anchor rods with steel guards
16—steel drums with both ends removed.
12—Pole type 400 ampere, 7500-volt disconnect switches.

Necessary dead end insulators, carriage bolts, eye bolts, lag screws and assorted flat washers.

LABOR REQUIRED TO INSTALL MATERIAL

SETTING POLES—includes digging the hole, sinking the steel drum, setting the pole with a line truck and pouring a transit-mix concrete base in the drum and final backfilling.
Digging the hole; required two men for each hole. Total time..... 6.0 m. h.
Setting the pole, concreting the base and backfilling; required six men for each pole. Total time 19.2 m. h.
Total time for installing one pole, including all operations..... 25.2 m. h.

INSTALLING POLE GUYS—includes digging the holes for the 12-in. by 12-in. by 6-ft. timber anchors and installing eight guy wires on the poles.
Total time .....42.0 m. h.
Average time per guy..... 5.25 m. h.

FAVORITE SPOT for James A. Feeley, president of Barnes-Pope, Boston contractors, is at the drafting table figuring out more efficient methods of installing electrical equipment. Jim has two famous sons who are also in the electrical industry; Jim Jr., a former Dartmouth football and hockey star is helping his dad in the contracting game while Henry, a former Holy Cross athletic star, is connected with the American Steel and Wire Company.

CROSSARM WORK—includes the mounting of 27 double crossarms and 26 single crossarms on the poles after they were set. Required two men working on each pole.
Total time; double arms.....42.0 m. h.
Average time per double arm.... 1.56 m. h.
Total time; single arms.....14.0 m. h.
Average time per single arm..... 0.54 m. h.
Total time; all cross arm work... 56.0 m. h.

LOWER EXISTING CROSSARMS—includes remounting, at a lower location, 18 single crossarms on 18 existing poles. One man required.
Total time .....21.0 m. h.
Average time per arm..... 1.17 m. h.

DEAD END WORK—includes the assembly and mounting of 30 dead end insulators on eight poles and two buildings. One man required.
Total time .....14.0 m. h.
Average time per unit..... 0.47 m. h.

STRINGING WIRE—includes the installation of 14,000 ft. of No. 4/0 and 2,000 ft. of No. 1/0 weatherproof wire, using a chain block to take up the slack. Wire was delivered cut to convenient lengths and reels were set at convenient points for feeding the cable. A total of 42 cuts were made in the conductors for dead ends and connections to 12 pole mounted disconnect switches. Six men were required.
Total time .....210.0 m. h.
Average time per 1000 ft. of cable ..... 13.125 m. h.

BUILDING CONNECTIONS—includes making 15 connections from five 3-wire pole line feeders to service entrance conduits at three buildings. One man required.
Total time .....7.0 m. h.
Average time per connection.....0.47 m. h.

INSTALL POLE DISCONNECTS—Includes the mounting and connection of 12 single pole 400 ampere, 7500 volt disconnect switches on three 45-ft. poles. Each group of three switches has an operating mechanism permitting a person on the ground to open or close the units. Two men required.
Total time .....42.0 m. h.
Average time per set of three switches .....10.5 m. h.

GROUNDING SWITCHES—includes driving four ground rods and making ground connections to the four switch operating mechanisms. One man required.
Total time .....7.0 m. h.
Average time per unit.....1.75 m. h.

Data from E. J. White Company, Newark, N. J.

TROLLEY MOUNTED FIXTURES

Mass production methods and straight line assembly was employed by this contractor in assembling and installing 210 trolley mounted fixtures in an industrial plant lighting installation.

Each fixture assembly consisted of a trolley, 4-inch octagon box, pull switch, swivel aligner, a 2-ft. 6-in. stem of ½-inch conduit, fixture canopy and reflector.

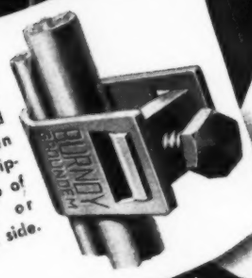
The following assembly procedure was used: trolleys were wired and mounted to the outlet boxes; switches

BY EWING GALLOWAY, N. Y.

Protect!

with BURNDY GROUND CONNECTORS

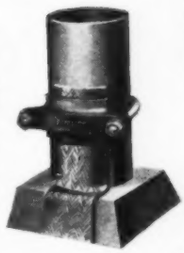
TYPE GH — Terminates ground lead to driven rod. May be slipped over top of electrode or around the side.



TYPE GD — For connecting two cables or a looped cable to a pipe or column, or for grounding fence posts. May be used with a variety of cable sizes.

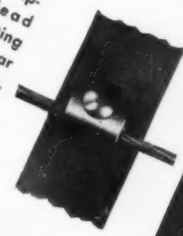
TYPE GX—Recommended for crossing conductors in the ground bus in order to secure greatest efficiency in reducing voltage gradient.

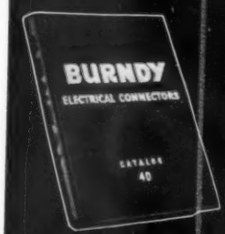
TYPE GG—For grounding operating rods, switch handles and gate posts, this connector can be used to join bar or braid to ground pipes, fence posts and columns.



TYPE GC
Attaches two cables of equal or varying diameters to flat metal surface. Without bar can be used as parallel groove clamp.

TYPE GB—For clamping ground lead cable to supporting steelwork, flat bar or equipment casing. Accommodates range of cable sizes.





When lightning strikes, your ground connectors will be on the job—if you use BURNDY Connectors. High-copper alloy and Everdur hardware provide mechanical strength, low electrical resistance, and high resistance to corrosion. Just a turn of the wrench to install.

For details, write for Catalog 40

TYPE GR

TYPE GP

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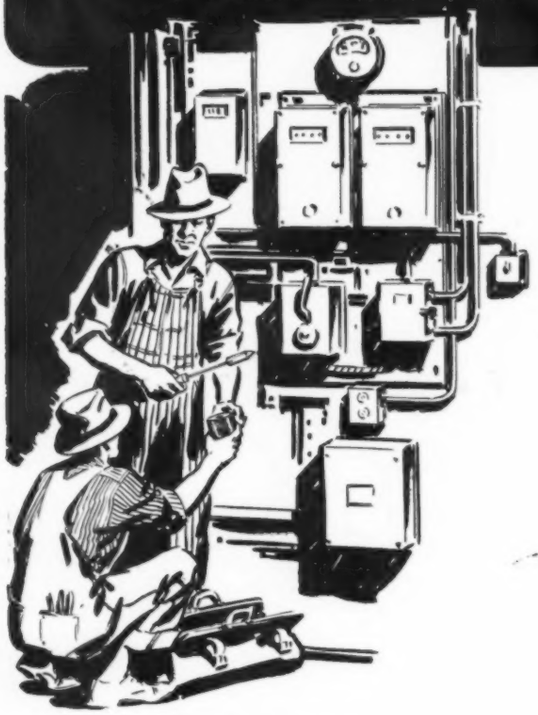

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STANDARD FOR ELECTRICAL WORK

Estimating

[FROM PAGE 106]

were mounted to the boxes and connections made; conduit stems were cut and threaded, both ends, on a pipe machine; canopies were wired and reflectors assembled; fixture stems with aligners were mounted to the fixtures; trolley-mounted outlet boxes were connected and fastened to the aligners. When all fixtures were assembled they were inserted into the trolley duct and lamped.

The labor breakdown per fixture, for each operation, is given below.

WIRING TROLLEY and mounting it to the outlet box.
Time ..... 10 minutes

WIRING PULL SWITCH, mounting and connecting it to the outlet box.
Time ..... 7 minutes

CUTTING FIXTURE STEM and threading it at both ends, on pipe machine.
Time ..... 3 minutes

WIRING AND ASSEMBLING FIXTURE canopy, reflector, stem and aligner.
Time ..... 10 minutes

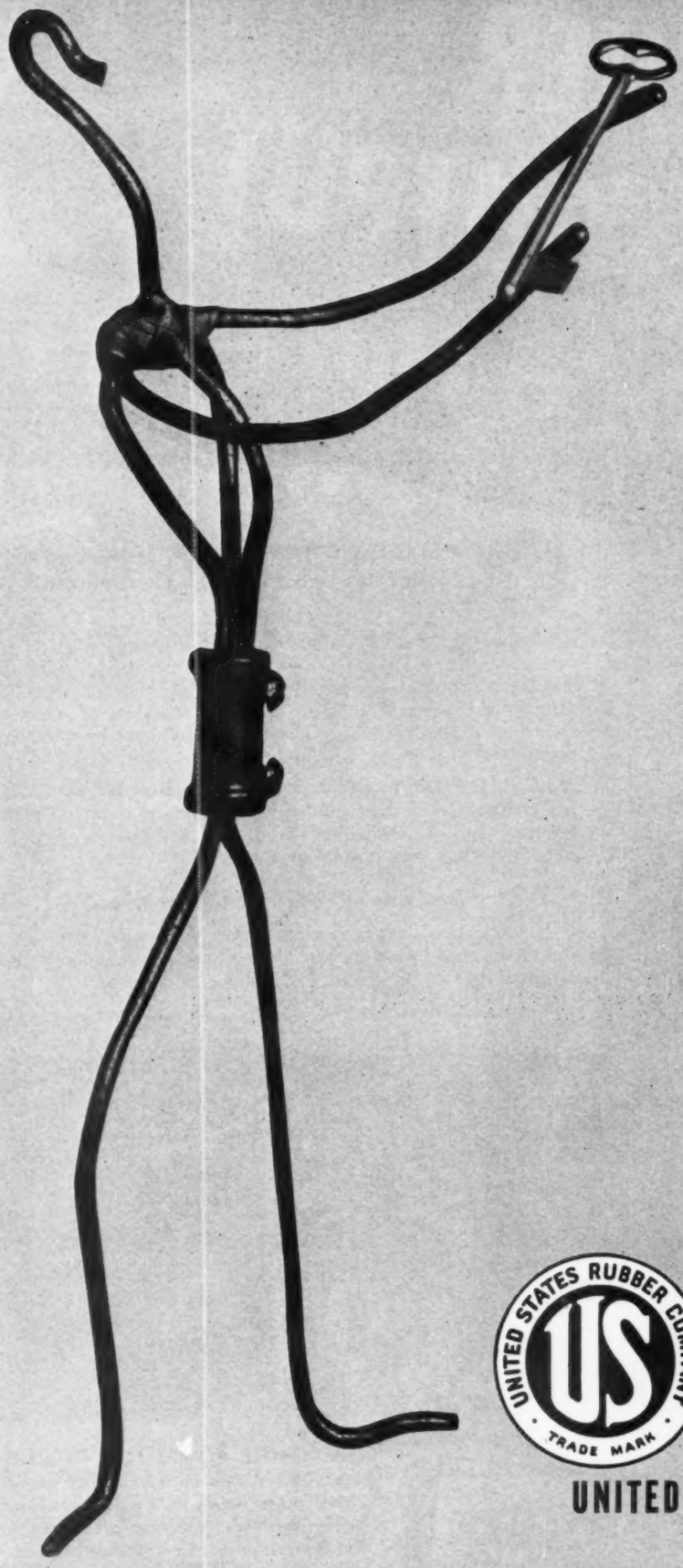
CONNECTING OUTLET BOX to the aligner and making the necessary splices.
Time ..... 5 minutes

MOUNTING FIXTURE by sliding it into an entrance coupling and spotting it.
Time ..... 5 minutes

ENTIRE FIXTURE ASSEMBLY includes a total of the above breakdown and gives the time for wiring, assembling and mounting a fixture complete with pull switch.
Total time per fixture ..... 40 minutes

Data from Garden Electric Co., Inc., Elizabeth, N. J.

***OVER HALF CENTURY** of electrical contracting experience is the foundation of the J. O. Forker & Sons organization in Brooklyn, N. Y. Thomas S. Forker (above) is the chime specialist of the firm, centering his interest in electrical bell and chime work in churches and other public buildings.*



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This unique combination of Laytex* and "Dilec," with the new and novel fibrous covering is Safecote *plus*—free skinning, fishable, flame-retarding, and moisture-resisting.

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MORE POWER FOR MORE OUTPUT ....in a Hurry!

1 NEED LOTS OF POWER QUICKLY? Install G-E Pyranol transformers indoors, right at the load centers

MORE POWER FOR STEEL OUTPUT—A simple, low-cost installation of three Pyranol transformers. Secondary runs are short; the transformers are located right at the load—without a fireproof vault.

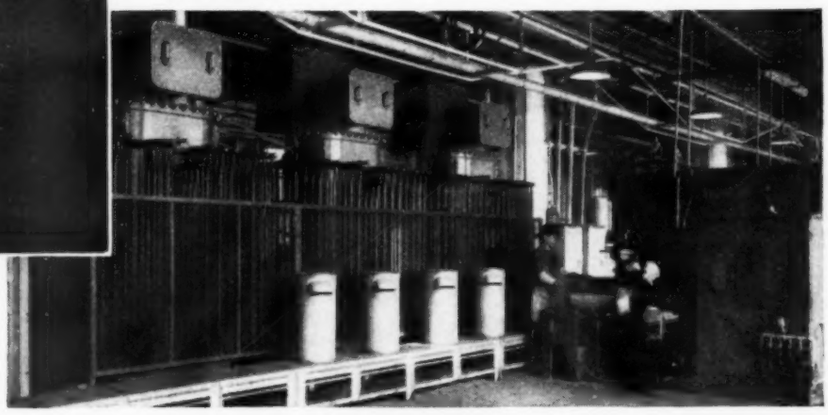
Installing Pyranol transformers is *fast—easy—simple!* No fireproof enciosing vaults are required because the cooling liquid, Pyranol, is noninflammable. Installing them is simply a matter of placing them at the desired location, running in small primary leads, and making the necessary connections.

You get savings, too, with Pyranol transformers. By locating them indoors near the load, you save on long secondary feeders, and in addition, the short secondaries give you better voltage and lower line losses.

Save with Air-cooled Transformers, too

G-E air-cooled transformers offer the same time- and money-saving advantages. They are particularly well adapted to use on circuits of 600 volts or less.

Write for Bulletin GEA-3377, "Ways to Save with Load-center Distribution of Electric Power."



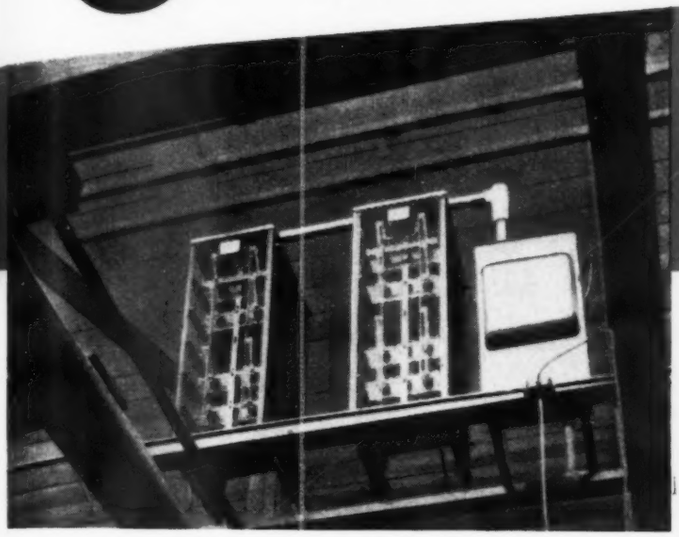
LOAD-CENTER POWER FOR WELDERS—Three 635-kva Pyranol transformers, an easy-to-install power supply for these large resistance-welding machines. Locating the transformers close to the load saved on secondaries—and no vault was required.

ACT NOW

EARLY ORDERS MEAN EARLY DELIVERIES — G-E Pyranol transformers and capacitors in popular ratings are carried in stock. We ship direct from the factory warehouse for fast delivery. Parts for G-E Pyranol and air-cooled voltage regulators are stocked for rapid assembly.

Call in a G-E representative *today*. He'll go over your distribution problems with you and help you select equipment that will best fit your needs.

3 FAST, LOW-COST WAYS TO GET ADEQUATE ELECTRICAL CAPACITY



CAPACITORS BOOST FEEDER CAPACITY, AND SAVE $2174 ANNUALLY—Pyranol capacitors totaling 300 kva were installed in the shops of Greenlee Brothers & Co., Rockford, Ill. Besides releasing valuable system capacity for useful loading, these Pyranol capacitors sliced more than $180 off the monthly cost of power.

2 WANT TO INCREASE WIRING CAPACITY AT LOW COST? Improve power-factor with G-E Pyranol capacitors

If power-factor in your plant is low, Pyranol capacitors offer the fastest, easiest way to increase the kw capacity of your present wiring. By improving power-factor they neutralize reactive (non-working) kva and enable the installed feeders to carry more working current.

Pyranol capacitors are easy to install, too—you can put them in many out-of-the-way locations.

Moreover, if your power contract contains a power-factor penalty or kva-demand clause, you can obtain direct savings through power-factor improvement that may *pay for the capacitors in from one to three years.*

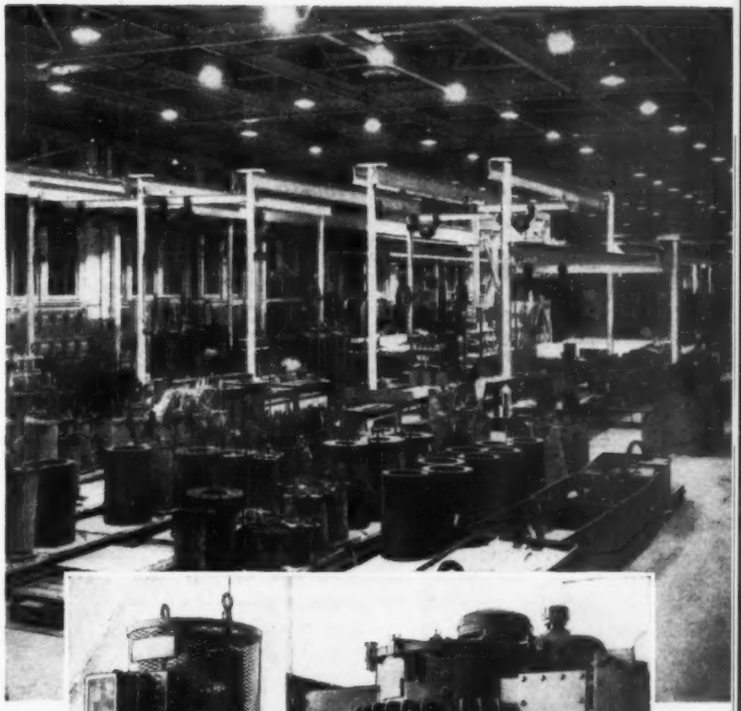
Write for Catalog GEA-77 "Pyranol Capacitors for Industrial Applications."

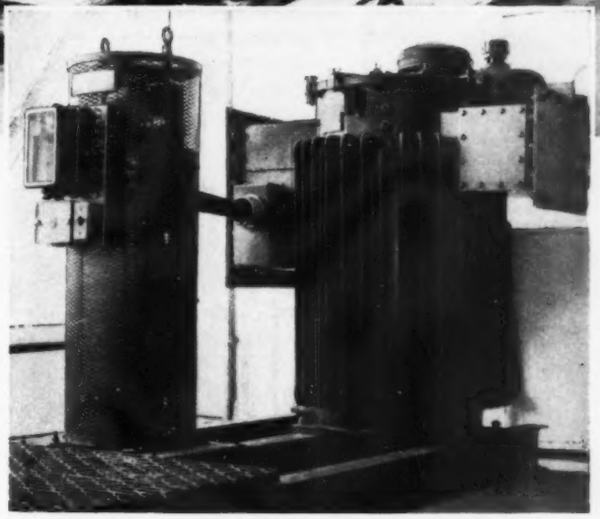
3 WANT TO BOOST LIGHT LEVELS—IMPROVE MOTOR PERFORMANCE? Correct feeder voltage with G-E induction regulators

Your plant circuits may be adequate from the standpoint of current-carrying ability, but the addition of more lamps, motors, and other equipment may cause excessive voltage drop. Low voltage means low lamp brilliance, low motor efficiency, and *worst of all*, curtailed production.

To bring voltage conditions back to normal and step up production, install G-E air-cooled or G-E Pyranol induction regulators. A speedy, low-cost installation job is assured because these regulators can be located indoors, anywhere. No vaults are required, so you save on time and materials.

Write for Bulletin GES-2285, "What's the Answer?" when poor voltage hampers production.





GUARDIAN OF THE LIGHTING LEVELS—High light levels for high-speed production are maintained in this large manufacturing plant by G-E Type AIRS induction regulators. This out-of-the-way installation is on an overhead beam (at the left of a Pyranol transformer). Time, space, and money were saved—no vault was needed.

GENERAL ELECTRIC

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Length of Tap

Q. *"Please tell me the reason why taps not over 25 feet in length terminating in an overcurrent device must be ⅓ the capacity of the conductor supplying same."—E.J.E.*

A. In setting up the rule in Section 2434, sub paragraph d, that a tap not over 25 feet long which is suitably protected against mechanical injury and which terminates in a single protective device must have at least one-third the carrying capacity of the conductor to which it is connected, the thought was kept in mind that in the twenty-five foot run the only trouble which could develop, would be a short circuit and that a short circuit would blow the fuses or open the circuit breaker before the tap would be damaged. It must be remembered that short circuits operate very fast and are soon over and in fact are so quick that the wires can carry the 300 per cent of current for the short duration of the short circuit.

Size of Power Feeders

Q. *"Is it permissible to run 3-phase, 4-wire feeders to distribution cabinets of smaller size than the total starting currents required for running large motors and M-G sets connected from same distribution panel?"* V.A.L.

A. Yes. Section 4314 provides that a feeder shall have a carrying capacity of at least 125 per cent of the full load current of the largest motor plus the sum of the full load currents of the rest of the motors.

This, naturally is much less than the sum of all of the starting currents of all of the motors. This rule recognizes the fact that all the motors of a group are practically never started at the same time.

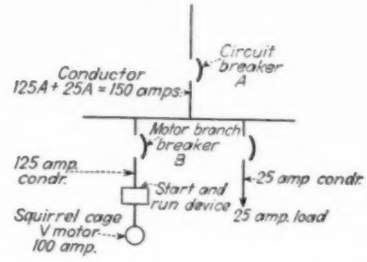
Motor and Light Feeder Protection

Q. *"Here is a little problem that I would like a ruling on.*

Problem: Assume a group installation as shown in the diagram. The conductors must have current carrying capacities indicated (Rule 2202) and the breaker A must have a setting not more than 125 per cent of the allowable current carrying capacity of the conductors, which is equal to 125 per cent of 150 or 187½ amperes (Rule 2432). The motor branch breaker, B, may have a setting as high as 400 per cent of the motor full-load current, or 400 amperes (Rule 4342). Assume that the 400 ampere setting is required to start the motor. Rule 4363 seems to permit a setting of 400 plus 25, or 425 amperes for the breaker, A, while Rule 2432 permits a setting not more than 187½ amperes. This means that breaker A will trip out when the motor is started.

"Is it correct to set A at 425 amperes according to Rule 4363 without any change in conductor size (as marked in the diagram and according to Rule 2202)?

"Are not Rules 2432 and 4363 in conflict?"—W.A.H.


Circuit breaker A
Conductor 125A + 25A = 150 amps.
Motor branch breaker B
125 amp. condr.
25 amp. condr.
Start and run device
25 amp. load
Squirrel cage V motor 100 amp.

A. After reading all of the above the picture presented to mind was that of the small fat boy at the party grabbing his hands and arms full of everything he could find.

As we are dealing with a motor installation let us stick with the rules pertaining to motor work which are contained in Section 430. Why scout around all through the Code to take advantage of everything that can be found to break down the safeguards of motor circuit protection?

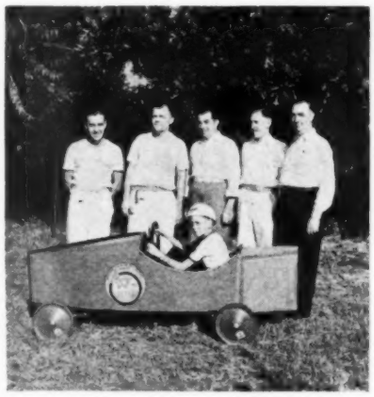
Also in Article 240 on Overcurrent Protection we find (in Section 2402) that "Equipment shall be protected against overcurrent as specified in Motors—Article 430" and in Section 2403-b "Motor Circuits. The conductors supplying motor and motor-operated appliances shall be considered as protected by overcurrent devices specified in Sections 4322, 4324 and 4342." And again in Section 2407. "Motors. For motor running protection the number of overcurrent units shall be as specified in Sections 4326 and 4327."

Thereby Article 240 gives over its jurisdiction to Article 430 in regards to motor work. And Article 430 is sufficiently liberal. Therefore Rules 2432 and 4363 are not in conflict.

Our inquirer has given the correct size of conductors. The protective devices, however, should be as follows:

The motor protection at the "starting and running device" must not exceed 125 amp. rating.

The motor branch circuit protection at B should not exceed 250 amperes (see Table 15 Chapter 9 and Section 4342) and must never exceed 400 amp. (and should not be at 400 amperes when anything less will do).



CONTRACTORS' ENTRY — Piloted by speedster, Mecur Post, and sponsored by the Contractors' Division of the Central Jersey Electrical League, this streamlined racer carried the A/W colors in a local Soap Box Derby. The bevy of smiles belong to (left to right) Ronald King and Charles Burkert, Central Jersey League; Jack Baumgarten, Essex League; Jerry Madden, C.J.E.L. and Robert Downing, New Jersey Council of Electrical Leagues.

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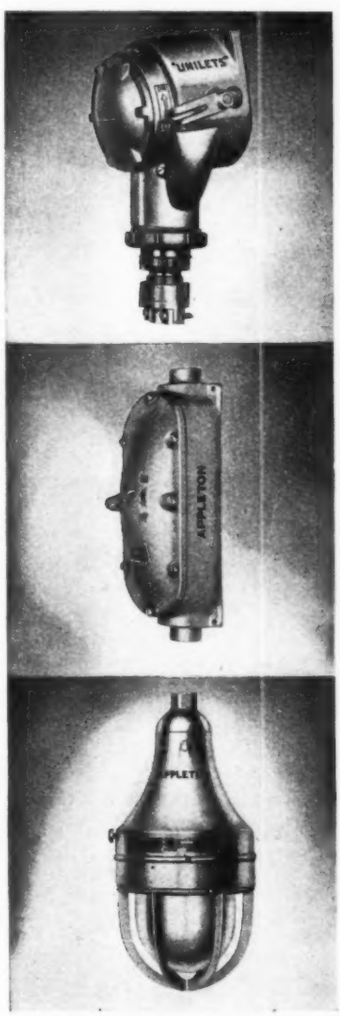

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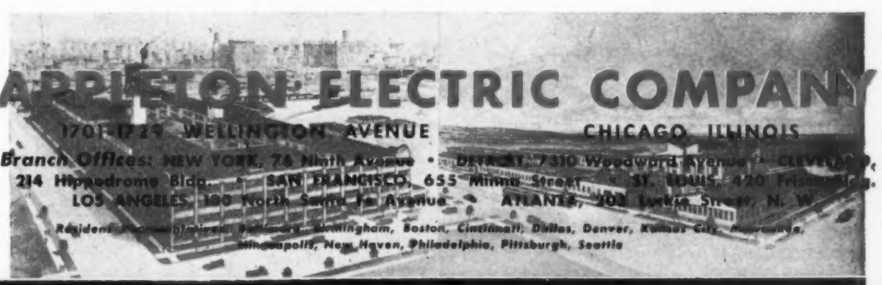
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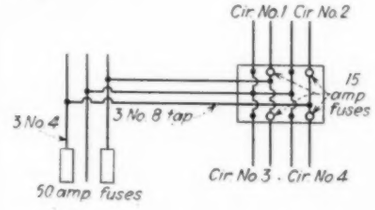
Questions on the Code

[FROM PAGE 112]

The feeder protective breaker at A may be selected at 25 amperes plus 250 amp. which equals 275 amp. This may be increased to 425 amperes only if absolutely necessary.

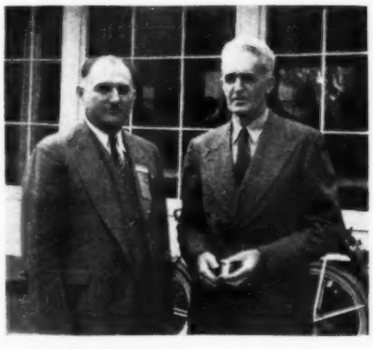
Tap Conductor

Q. *"Please advise if No. 8 tap feeder properly protected against mechanical injury less than 25 feet long and terminating in a four circuit panel box serving four 15 amp. branch circuits, as per diagram below, would meet Code requirements under Section 2434, or would it be required to first terminate the tap in a single set of fuses ahead of the branch circuit fuses."*—A. M.



A. With two 15 amp. branch circuits on each side of this 3-wire system the maximum load on the tap conductor is limited to 30 amp. which is 5 amp. less than the 35 amp. as allowed for No. 8 RC wire, and the setup as per the diagram will be all right if the tap is not over 5 feet long.

But where the tap is over 5 feet and does not exceed 25 feet the tap would have to terminate in a single fuse of not over 35 ampere capacity.



REPRESENTING *electrical contractors at the Southwestern Section annual meeting of electrical inspectors were J. D. O'Connor, Lupen & Hawley, Sacramento, officially representing both the Sacramento and Northern California Electrical Contractors Assns., and Capt. J. W. Baldwin, secretary of the Santa Barbara Electrical Contractors Assn., also representing other southern California groups. Santa Barbara contractors turned out in numbers for meetings and assisted in hospitality to the visiting inspectors.*

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In the News

NEW WIRES CONCERN INSPECTOR MEETINGS

Although "flying blind," not having the 1940 National Electric Code on hand to go by, electrical inspectors of the two far western sections in their annual meetings at Santa Barbara and Great Falls, respectively, found this no serious handicap to discussing that code. The Southwestern Section met in Santa Barbara, Aug. 26-28; the Northwestern at Great Falls, Montana, Sept. 3-6.

Major interest on both programs was centered on the new wire tables, new carrying capacity ratings, conduit fill and ambient temperature limitations, and the new wires themselves. Howard Weber, commercial engineer, U. S. Rubber Co., New York, explained them at both western meetings. S. J. Rosch, manager of research for Anaconda Wire & Cable Co., "pitched on the home grounds" for the new wires and new ratings. For Great Falls is the primary wire manufacturing center for his company's product.

The Great Falls meeting, with 321 registered, was the largest in the Section's history, and the most brilliant from the standpoint of original entertainment. Anaconda Copper Co., Anaconda Wire & Cable Co., and its affiliated Montana Power Co. made it so. An Indian ceremony and pageant at the foot of Great Falls itself was the most spectacular event in Northwest electrical history in some time.

At Santa Barbara, cautiously expressed by Ralph Wiley, chief of San Francisco's electrical department, was a sentiment unofficially discussed in many off-the-floor conferences that perhaps diversity had not been given enough consideration in the new carrying capacity schedules, especially of the heavier conductors. Another complaint made was that diversity allowances were too great on busing of circuit panelboards in view of modern loadings. Contractors, it was declared by inspectors, order such panelboards simply by number of circuits and use them indiscriminately on heavily loaded 15-amp., even 20-, and 30-amp. lighting circuits when busing is based only on an average of 6 amp. per circuit.

At the Great Falls meeting L. W. Going, chief inspector, Portland, recommended a new article to the Code to classify wiring methods permissible within certain fire zones. Armored cable troubles were given a work-over at the Wednesday morning breakfast.

Otis W. Newcomb, city inspector, Long Beach, Calif., was elected president of the Southwestern Section; Harold Gerber re-elected secretary-treasurer; Clifford Prudhomme, a former contractor, now city inspector of Sacramento, was named first vice-president; and O. D. Butterfield of Torrence, second vice-president. San Jose was selected for the next annual meeting place.

I. B. Sturges, inspector of Portland, Ore., was elected president of the Northwestern Section; Fred Weber re-elected secretary-treasurer; W. L. Gaffney of Tacoma, first vice-president; and W. R. Volheye, chief electrical inspector of Oregon, second vice-president.

SOUTHERN INSPECTORS STAGE CODE QUIZ

Reviewing detailed Code problems by prepared questions and answers in the popular radio quiz program style was an innovation in Section meetings staged by the Southern Section, International Association of Electrical Inspectors in Houston, Tex., September 16–18. The 12th annual meeting was attended by 350 electrical inspectors, their business associates and friends.

Called to order by President C. S. Whitaker of Durham, N. C., the delegates were cordially welcomed to Houston by Mayor Oscar F. Holcombe and other city officials. T. W. Bowry of Richmond, Va., responded to the welcome.

IAEI President K. W. Adkins in the president's address reviewed the work of the organization during the past year, stressing the importance of the influence of Sections and Chapters in the development of the National Electrical Code. International Secretary V. H. Tousley reviewed recent trends in Code changes.

The detailed Code discussions were handled by members of the article committees in quiz program style. V. H. Tousley reported on Articles 100-110 regarding definitions. George Welman, Harvey N. Pye, J. G. Fisher, A. H. Schirmer and J. L. Speights handled the Code chapter devoted to wiring design and protection.

On wiring methods and materials the article discussion was presented by Howard H. Weber, Joe Schwegman, H. G. Knoderer, F. G. Camus, J. Werner Pyles, H. H. Schamburg, J. H. Eberling, E. A. Thibodeaux and J. W. Wagoner.

J. W. Whittington reported on the rules pertaining to flexible cords; C. S. Whitaker on fixtures, lamps and appliances; J. M. Flanigen on motors and control; and L. F. Adams on transformers, capacitors and resistors.

Rules regarding special conditions and hazardous areas were discussed by T. S. King, Joe Whitner, G. G. Griffen, C. T. Jones and A. E. Hancock.

Between Code quizzes, J. L. Wagoner in

PRIZE WINNER Herman E. Gerboth, Cincinnati electrical contractor, and the float which placed first among 187 entries in a recent parade in Cincinnati. Mr. Gerboth conceived this idea of advertising his business and promoting adequate wiring and was able to develop it with the cooperation of the Cincinnati Electrical Association and the Cincinnati Gas & Electric Co.

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In the News

[FROM PAGE 116]

a talk on the protection of power and light circuits introduced for the first time a new circuit breaker operating by both thermal and magnetic action. E. G. Romeiser, of Porcelain Products, Inc., presented a moving picture of the manufacture of electrical porcelain. G. E. Manning of the Underwriters Laboratories discussed recent developments in the electrical field. G. M. Kintz, of the Bureau of Mines spoke on fires and explosion from electrical causes.

Officers elected at the closing session were Frank G. Camus, president; W. A. Stall, first vice president; J. M. Murphy, second vice president; and Joseph Whitner, secretary-treasurer.

WESTERN INSPECTORS REVIEW CODE

Breaking previous attendance records with a registration of 600 members, the Western Section, International Association of Electrical Inspectors met in Kansas City, Mo., on Sept. 23–25 for the 36th annual meeting of the organization. The new 1940 revision of the National Electrical Code made its bow in published form and discussions of the new provisions held the attention of the delegates through most of the three day program.

The traditional "code breakfasts" for the discussion of inspector problems were held with Clifford Anderson of Oklahoma City presiding. S. B. Williams, editor of *Electrical World*, addressed a joint luncheon with the Kansas City Electric Association on the position of the electrical industry in national defense.

Adjoining the meeting hall, 29 exhibitors displayed new wiring materials, panelboards, switches, fuses, motor controls, transformers and porcelain products. Entertainment committees headed by O. C. Lake and E. L. Schott arranged a "Night in Reno" and the annual dinner dance.

The business sessions were conducted by President James Galbraith of Detroit. K. W. Adkins, IAEI president, reviewed the accomplishments of the international organization and pointed out the influence of the Section in the development of the Code. Inspectors, he said, have the technical talent and field experience. V. H. Tousley, secretary of IAEI, emphasized the inspector's importance in national defense, urging them to exercise sound judgment to expedite industrial efforts.

Speaking for organized labor, M. H. Hedges of IBEW paid tribute to the inspector as a member of the electrical community capable of "disinterested decisions" on electrical standards. A. R. Small, chairman of the Electrical Committee, NFPA, directed attention to a new trend indicated by new Code rules regarding fusing.

The detailed discussion of articles was led by D. J. Talbot on definitions, Arthur L. Abbott on branch circuits and feeders, O. K. Coleman on services and Hugo Ries on overcurrent protection.

Questions and answers on the new wires were presented by Howard H. Weber of the U. S. Rubber Co. in a simulated "radio quiz program". Two moving pictures were shown, on the manufacture of electrical porcelain by E. C. Romeiser of Porcelain Insulated Wiring Systems and on counterfeit money by agents of the U. S. Treasury Department.

A. B. Smedley, Anaconda Wire & Cable Co., presented a demonstration of the effects of voltage loss due to resistance and reactance. N. C. Fetter, Micro Switch Corp., spoke on inherent overheating protection in motors. J. L. Wagoner, Westinghouse Electric & Manufacturing Co., described a new circuit breaker employing thermal and magnetic action.

A discussion on Code articles pertaining to wiring methods, outlet boxes and auxiliary gutters was led by L. P. Dendel of Lansing. Lee F. Adams of Schenectady reported on Article 250 (grounding); H. J. Morton, Detroit, and G. C. Monroe, Springfield, Mo., on Article 422 (appliances); C. M. Park, Chicago, on hazardous locations and F. O. Evertz, Columbus, on X-ray and high frequency equipment.

"That's just what he gets for cutting bids so low all the time."

WIRING AND LEAGUE CONFERENCES

The Palmer House in Chicago will be the scene of the Fifth Annual Conference of the International Association of Electrical Leagues on November 13-14. The sessions will be open to any member of the industry interested in league activities.

On November 12 a pre-conference meeting will be jointly sponsored by the IAEL and the National Adequate Wiring Bureau to discuss the promotion of residential wiring activities.

Commercial and residential wiring and rewiring, fluorescent lighting, trade and public relations and promotion will be discussed at the league meeting.

COMING MEETINGS

International Association of Electrical Inspectors—Eastern Section, New York, N. Y., Oct. 7-11.

National Electrical Contractors Assn.—Annual Convention, George Washington Hotel, Jacksonville, Fla., Oct. 21–23.

National Electrical Wholesalers Association—Semi-Annual Convention, Hotel William Penn, Pittsburgh, Pa., Oct. 22–25.

National Electrical Manufacturers Assn.—Annual Conference, Waldorf-Astoria Hotel, New York, N. Y., Oct. 27 to Nov. 1.

International Association of Electrical Leagues—Annual Conference, Palmer House, Chicago, Ill., Nov. 13–14.

North Dakota Electrical Contractors' Association—Annual Meeting, Fargo, N. D., Nov. 15–17.

INDUSTRIES CONVENTION AT ROCKY MOUNT, N. C.

The Electrical Industries Convention held on September 25 at The Ricks Hotel, Rocky Mount, N. C., afforded an opportunity for the electrical personnel of that state and surrounding territory to get together and spend a day discussing the many problems of the electrical industry.

The program included discussions on Accounting and Credits by J. H. Wentz, Graybar Electric Co., Raleigh; Cooperation with Industry by Martin Swartz, Supt. Public Utilities, Greenville; The Application and Operation of Fluorescent

VARNISHED CAMBRIC CABLE · RUBBER POWER CABLES · BUILDING WIRE

ARMORED CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · SIGNAL CABLE

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

CRESCENT

CRESFLEX

Non-Metallic Sheathed Cable

Here's an *improved* CRESFLEX using Type R conductors with flame retarding and moisture resisting finish printed to show the size, type of insulation and voltage.

A further advance in construction has been developed by CRESCENT in a new method of applying the protective sheath to provide a more flexible cable that makes for easier fishing and faster, low cost installation.

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT SUPPLIES

the following choices of insulation for standard building wires and cables:

Code Grade, Type R
30% Performance Grade, Type RP
ENDURITE Heat Resistant, Type RH
IMPERVEX Moisture Resisting Grade, Type RW
SYNTHOL Synthetic Insulated, Type SN

and here is a partial list of CRESCENT products:

Genuine A.B.C. Armored Bushed Cable
Flexible Steel Conduit
Bare Copper Wire and Cable
Flexible Cords
IMPERIAL Portable Cords and Cables
Parkway Cables
Rubber Power Cables
Service Cables
Signal and Control Cables
Trench Cables
Varnished Cambric Cables
Weatherproof Wires and Cables

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

HERE'S "4-Square" VALUE

. . . from a "One-Call" Source

THOR-NADO Electric Hammer

"Slingshot" drive of this new hammer gives "a more powerful blow than any electric hammer of comparable capacity, size and weight". Meets heavy-duty needs in work on stone, wood or metal. Write GRAYBAR for folder giving full specifications.

QUIK-LIFT Electric Hoist

The Coffing "Quik-Lift" can be plugged into any AC or DC circuit connection. Has heavy-duty motor. Sensitive control permits load to be raised or lowered to a fraction of an inch. Range of models from 250 lb. to 4,000 lb. capacity. Write GRAYBAR for details.

TWIST-LOCK Cord Connector

Portable tools and other leads need this "sure-power" connecting device. Plug it in, give it a twist and it's locked in place. Built by Hubbell to stand up under "slam-bang" usage in the shop. Ask GRAYBAR for details on the full line of Twist-lock receptacles, caps and other wiring devices.

SIMPLEX Cord, Cable

A tough "armor" of selenium rubber gives this cord extra strength to resist crushing, abrasion, tearing. Assures uninterrupted service from portable tools. Available in a wide range of sizes including cables for big industrial loads. GRAYBAR offers literature, samples.

When you go to GRAYBAR for electrical tools and accessories, you're sure of getting a product that's built to *stay in service* . . . one that meets GRAYBAR'S strict standards for electrical applications that must stand up under "slam-bang" shop conditions. What's more, because GRAYBAR sells *everything electrical,* you get the extra convenience of a "one-call" source of supply for related items. Cord, connectors and wiring accessories match up in performance with the equipment they're bought to serve on. Whatever your electrical needs, check with GRAYBAR today!

GraybaR
HEADQUARTERS for FLUORESCENT LAMPS—ACCESSORIES—REFLECTORS

Executive Offices:
Graybar Bldg., New York, N. Y.

OFFICES IN 83 PRINCIPAL CITIES

GraybaR QUALITY

Distributed and guaranteed by
GraybaR ELECTRIC COMPANY

In the News

[FROM PAGE 118]

Lighting by H. M. Horton, General Electric Co., Atlanta. N. E. Cannady, State Electrical Engineer and Inspector, outlined The New Code Changes, and L. W. Hays, Westinghouse Elec. Supply Co., Raleigh, spoke of the Jobbers Responsibility in the Electrical Industry. Roy Palmer of the Duke Power Co., Charlotte, covered the subject of Lighting. The contracting phase of the electrical industry was presented by Ralph K. Robinson, president, North Carolina Electrical Contractors Association in his talk on Electrical Contractors.

U. S. CONSTRUCTS MORE CANTONMENTS

With the arrival of M-day for the national guardsmen throughout the country and the presidential signing of the conscription bill, the task of constructing living quarters for this vast peace time army surges forward.

These cantonments, as they are called, are being built at defense points throughout the country and consist of temporary type wood structures including officers quarters, barracks, administration buildings, cafeterias, mess halls, recreation buildings, infirmaries, storehouses, machine repair and utility shops.

One outstanding example of the scope of this program is the construction at Fort Dix, N. J., where 862 separate buildings are being built to house a whole division at a cost of 5½ million dollars. Here the units vary in size from 36-ft. by 25-ft. to 108-ft. by 25-ft. Most of them are the one story type, with a few two stories high.

The electrical work, inside the buildings only, at this project costs approximately $180,000 and is being done by an electrical contractor, under sub-contract to the general contractor. The electrical construction consists of the installation of residential type services to each building with armored cable circuits to all lighting outlets and convenience receptacles. Most of the fixtures are of the direct enclosing globe type, with some drop cords, weathertight units for entrances and explosion proof fixtures for hazardous locations. Tumbler switches and duplex receptacles are of the molded plastic base type. All equipment must meet the rigid government specifications and all labor must be paid the prevailing wage scale.

Contractors doing this type of work are kept on their toes, for all work must be completed within 90 days from the award of the contract.

NEW MILWAUKEE E.M.E. OFFICERS

Milwaukee Electrical Maintenance Engineers have elected T. R. Schowalter president for the 1940-41 season. Henry G. Kettner was named vice president and A. L. Krumhaus, secretary-treasurer.

Recommend HAZARD PERFORMITE

Type RH *and* RHT Wires

PERFORMITE WILL CARRY HEAVIER LOADS		
Current-Carrying Capacities in Amperes Conductors in Raceways		
Size AWG or MCM	Type R 1940 Code	Type RH & RHT* 1940 Code
14	15	22
12	20	27
10	25	37
8	35	49
6	45	65
4	60	86
2	80	115
1	91	131
0	105	151
00	120	173
000	138	199
0000	160	230
250	177	255
300	198	285
350	216	311
400	233	336
500	265	382
600	293	422
700	320	461
750	330	475
800	340	490
900	360	519
1,000	377	543
1,250	409	589
1,500	434	625
1,750	451	650
2,000	463	666
*Type RHT is permissible in sizes Awg 14-8 inclusive.		

Performite is the highest grade rubber insulation used on commercial building wire. The 1940 National Electrical Code permits Performite Type RH and Type RHT super-aging wires to be operated at 75° C. as compared with 50° C. for ordinary Type R wires. This means more capacity.

Performite Type RH wires, available with full insulation walls in all standard sizes, are recommended for general wiring. Performite Type RHT (small diameter) wires with 1/64 less insulation on sizes 14, 12, 10 and 8 can be used for general wiring and also for rewiring. When used for rewiring, the new code regulations permit the use of Performite RHT under conditions which greatly increase the capacity of existing raceways.

Write us for full information.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta Dallas Washington Cleveland

Pittsburgh Buffalo Boston Detroit Seattle San Francisco St. Louis Los Angeles

STREAMLINE YOUR WORK!

with

Wire-Nuts

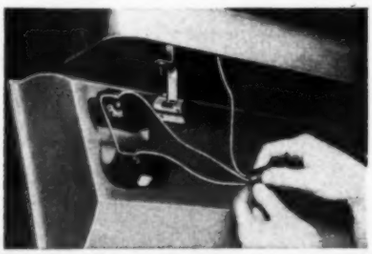
Tapered spring insert forms thread marks in wires, making perfect electrical contact. No solder, no tape—no waiting, no special tools.

SKIN WIRES—TWIST ON—THAT'S ALL!

Meet competition by simplifying the time-consuming operation of making wire joints—hanging fixtures—roughing in jobs, etc.

Simply strip wires and screw on a "Wire-Nut." The joint is finished as easily as screwing a lamp in a socket! "Wire-Nuts" are made in sizes for every common wiring joint. Temperature changes do not weaken their mechanical or electrical contact. No damage from cuts or abrasions. "Wire-Nuts" make a joint that is better electrically and stronger mechanically—as every inspector knows.

Write today for your FREE SAMPLES. Handle more jobs—with "Wire-Nuts."



IDEAL "Wire-Nuts" are really "the nuts" for installing Fluorescent Fixtures
FULLY APPROVED. LISTED BY UNDERWRITERS' LABORATORIES, INC.

MILLIONS IN USE!

Electrical Products Division

IDEAL COMMUTATOR DRESSER COMPANY

1041 Park Avenue, Sycamore, Illinois

In the News

[FROM PAGE 120]

The fall meetings got under way on September 24 with a discussion of the new wiring code and inspection requirements by Wm. A. Haig, chief electrical inspector of Milwaukee. Wisconsin, operating under a State code, recently adopted amendments paralleling the 1940 revisions in the National Electrical Code.

BURBANK HAS "GOLD SEAL" WIRING

Burbank, California, has its own certified wiring program known as the "Gold Seal" wiring plan. It is operated by the Gold Seal Building Industries, a local organization that fosters the employment of a reputable building contractor on home construction and licenses qualified electrical contractors to make Gold Seal wiring installations.

To qualify for a Gold Seal license, the electrical contractor must have the experience and equipment to do first class work and must be financially able to pay all his bills promptly.

To insure good workmanship and the installation of standard materials, Gold Seal wiring carries with it a certificate which guarantees the material and workmanship for a period of three years and certifies that the guarantee is backed up by a deposit of a $1000 bond. If the contractor defaults in making legitimate repairs within 48 hours of notification, Gold Seal Building Industries will make the necessary repairs and charge it against the contractor's share in the trust fund. This fund is established by an assessment of $2.00 per job for each licensed contractor. If the contractor goes out of business or withdraws from the plan, after three years (guarantee period) and three months (claim period) a refund of 70 per cent of his trust fund share is made to him.

To pay for the use of the trade mark and the plan, each contractor pays a small license fee for each job done. All Gold Seal installations have a brass plate on the main panel carrying the trade mark and the contractor's name and telephone number.

Newspaper advertising of the plan is designed to reach builders, real estate operators and prospective home owners. The organization letterhead contains the names of all licensed Gold Seal electrical contractors.

This program is now operated in Burbank and Glendale and at present applies only to one-family dwellings. Future plans call for the inclusion of multiple-family dwellings and small commercial and industrial installations.

A.W. ACTIVITIES PROGRESS

The National Adequate Wiring Bureau continues unceasingly in its effort to better wiring in the homes of the nation.

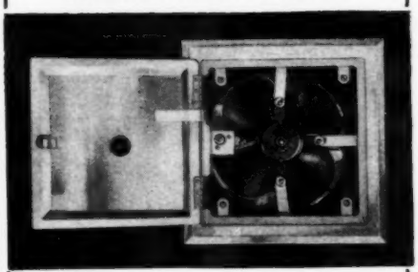
WOLVERINE SOLDERING LUGS

- *High-Conductivity*
- *Square-End*
- *Uniform Dimensions*

BUY FROM YOUR JOBBER

WOLVERINE TUBE CO.
DETROIT, MICHIGAN

EVERY KITCHEN NEEDS A SIGNAL VENT FAN—



Models to fit walls 6" to 30", with a list price for 110-Volt A.C. 60-cycle, for 6" to 11½" walls, $21.50, the automatic built-in type, shown above for permanent installation, is telescopic in design. Can be installed in new or old houses. Easy to install. 10" quiet type fan blades. Door operated switch. Totally enclosed motor. Automatic weather-tight shutters. Air displacement 650 C.F.M. Finish of inside section and door is white; fan is brown with polished aluminum shutter vanes. Write for details today.

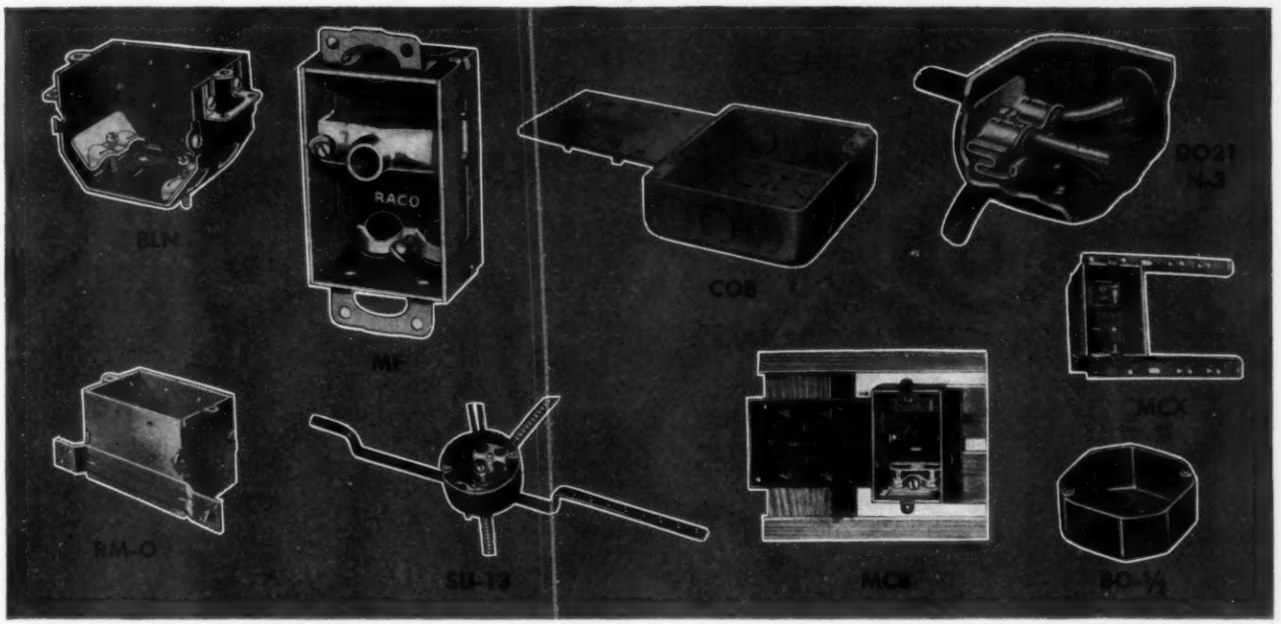
SIGNAL ELECTRIC MFG. CO.

Menominee, Michigan

Offices in principal cities

SIGNAL

A PLUS LINE!



THE SURE WAY TO MEET THE REQUIREMENTS OF THE 1940 CODE

NEW developments and new standards have changed industrial, commercial and residential wiring. The contractor can no longer depend on what once seemed adequate. Nowhere is this more evident than in the 1940 Electrical Code—it emphasizes the need for a PLUS LINE!

Raco • All-Steel has kept in step with wiring trends in every section of the country—with a complete line, tailored to fit the 1940 needs.

In **Outlet Boxes,** for instance, Raco • All-Steel makes all standard sizes—3¼" Octagon, 4" Octagon, 4" Square, 4⅛16" Square—in all standard depths and all standard KO arrangements.

PLUS

Every required assembly of Clamps, Brackets, External Ears, Box and Bar assemblies.

When you standardize on Raco • All-Steel • Products, a complete line of **Switch Boxes**—all the standard Square Cornered and Beveled Cornered Boxes—is at your service.

PLUS

All the newer and more efficient styles of Clamps, Extended Ears, Mounting Brackets, Lath Supports, Side Mounts, and Fixture Bridges.

The same high quality and the same completeness characterize all Raco • All-Steel • Products. You can't go wrong when you use them. They provide many advantages for rural and urban modernization work. Architects, Contractors, Electricians and Builders have given Raco • All-Steel • Products their stamp of approval—and you may be sure that this PLUS LINE will command new preference in 1940 and 1941.

Write for your copy of the Raco • All-Steel • Products catalog . . . it's yours without any obligation

Distributed Nationally by **ALL-STEEL-EQUIP COMPANY,** INCORPORATED

610 Griffith Ave., Aurora, Ill. • *Factories:* South Bend, Ind., Aurora, Ill.

RACO • ALL-STEEL • PRODUCTS

Switch Boxes • Outlet Boxes • Cutout Boxes • Cabinets • Conduit Fittings

Distributors in All Important Centers

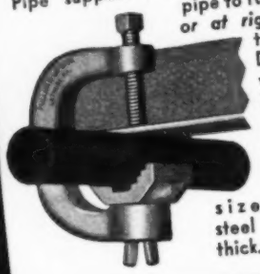
FLOOR BOXES and WIRING SPECIALTIES

No. 130 Adjustable Water Tight Floor Box

No. 130 Box with No. 207 Bell Nozzle. Cut-away view illustrates how tapered unit receptacle fits tapered opening in adjustable ring. Cover plate 3½"—overall height 3½".

No. 470 Pipe or Conduit Hanger

Pipe support turns freely, allowing pipe to run parallel or at *right angles* to beam. Does away with drilling or use of straps. Handles ½", ¾" and 1" size pipe, to steel beams ⅜" thick.



No. 330 "Latrobe" Tom Thumb Utility Outlet

To be used in wood installations and other locations free from moisture or mechanical injury.

• The *Latrobe Line* is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties

Write for details TODAY!

FULLMAN MFG. CO.

LATROBE • PENNA.

In the News

[FROM PAGE 122]

The success of the promotional plans together with new advertising schemes, new certification plans, more homes certified and increased interest in good wiring are continuously reported by the many key points throughout the country.

Here's what is happening in the field.

Jacksonville, Fla.—The City Electric Plant sponsors a "Better Living" program each day over a local radio station and offers a wiring layout service to the customer and his architect.

San Francisco, Calif.—The 2,000th Red Seal Adequate Wiring Certificate has just been awarded to one of the Standard Building Company's Sunstream Homes.

Philadelphia—A triple seal long range plan incorporating adequate wiring has been inaugurated by the Philadelphia Electric Co. in cooperation with the Electrical Association of Philadelphia. The three seals cover: (1) Adequate Entrance Service; (2) Adequate Wiring, and (3) All-Electric Home. Thus an All-Electric home is reached in three successive stages beginning with the service. As each stage is reached the seal of approval is given.

Buffalo, N. Y.—Recent plans call for the construction of approximately one hundred 5-star homes in a development at Williamsville, a suburb of Buffalo. Twenty-five of them will be completed this year.

Chattanooga, Tenn.—Four new A/W certified homes were opened for inspection by W. F. Osborne, builder. All wiring features were identified by marker cards. The builder reports several prospects.

Fond du Lac, Wisc.—The Adequate Wiring Bureau of Fond du Lac is the 41st local group to receive a license to undertake the certification activity. The bureau will operate in the city and certain portions of Fond du Lac County. Two of the three members of the sponsoring committee were electrical contractors.

New Orleans, La.—A promotion plan for adequate wiring developed by the Electrical Association features a prize contest for contractors on certified A/W installations. Both local utility companies are supporting the program.

DEADLOCKS BROKEN — Zenna Hirsch, president, Oklahoma Electric Supply Co., one of the largest electrical contractors in Oklahoma City, employs an impartial arbiter when disputes over specification intent are stalemated. According to Mr. Hirsch, this is the most effective method of settling the disputes that are bound to arise.

MINERALLAC HANGER

Conduit ⅜"—2½"
Cable to 2⅛" (with Bushings)

Cadmium and Everdur
MINERALLAC JIFFY CLIP

Sizes from .250" O.D. Tubing to 1¼" conduit.

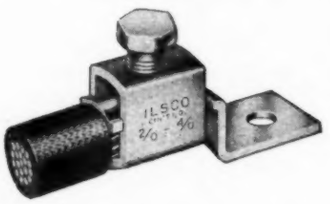
See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

ILSCO
SOLDERLESS CONNECTORS

. . . ARE APPROVED BY UNDERWRITERS' LABORATORIES



under new May 1, 1940, Standard for Pressure Wire Connectors.

Connect "FOR KEEPS" with ILSCO connectors. They're better than ever

Write today for samples.

ILSCO COPPER TUBE AND PRODUCTS, INC.
5629 MADISON ROAD — — — CIN., O.

Dayton, Ohio—Increased interest in certified wiring promotion is being shown by operative builders and the public. Thirty homes have been certified by the Dayton A/W Bureau, which in cooperation with a realtor, an electrical contractor and an electrical supply company have opened a model home for public inspection.

Toledo, Ohio—Adequate wiring is being promoted by the Toledo Edison Co., through a close check on all new construction permits within the city. All prospective home-owners are contacted and offered the company's wiring, lighting and kitchen planning services. Of those contacted, 70 per cent have accepted the service.

BOOK REVIEWS

Troubles of Electrical Equipment

In this second edition all the material is brought up-to-date. The book is written on the basis of the author's experience of more than thirty years as an erecting, maintenance and consulting engineer. The material is presented in a diagnosis form, taking step by step the symptoms, cause and remedy of the trouble.

Written in an easy style and in plain language, this volume should be an invaluable aid to both the beginner and veteran trouble-shooter, plant electrician, maintenance man, electrical contractor and anyone interested in the application, operation and maintenance of electrical equipment.

Eighteen chapters comprehensively cover: The Application, Operation, Maintenance and Troubles of Induction Motors, Synchronous Motors, Direct Current Generators and Motors, Transformers, Auto-transformers, Air- and Oil-Circuit Breakers and Relays, Lightning Arresters, Voltage Regulators; Operation and Connection of Instrument Transformers; Industrial Motor Control, Selection of Industrial Motors; Insulation-Resistance Tests; Economic Use of Power; Power Factor; Scheduled Maintenance; The Load Survey; Industrial Plant Lubrication; Determination and Location of Cable Faults. Troubles of Electrical Equipment. By H. E. Stafford, Member AIEE and Association of Professional Engineers of Ontario. Price $3.00, 373 pages. Cloth bound. McGraw-Hill Book Co., 330 W. 42nd St., New York City.

Simple Blueprint Reading

This book affords a basis for the study of blueprint reading and, while it has been written with special reference to welding, it contains information of value for anyone concerned with mechanical construction. It should be of interest to all in the construction and production field who have occasion to prepare or read mechanical and structural drawings.

While the subject matter of the book is focused primarily on welding drawings, it covers the following fundamental phases of mechanical drawing: Picture drawings of the subject; perspective and isometric drawing, their function and limitations; orthographic projection, hidden and visible lines; dimensions; scale drawings; auxiliary views; presenting and interpreting slanting surfaces accurately; screw thread interpretation; method of indicating the type, size, shape and length of a weld and other necessary information. The illustrations contain drawings of machine parts, pipe connections, tanks and general construction. A list of questions enables the reader to check his knowledge. Simple Blueprint Reading. 138 pages. 164 illustrations. Semi-flexible simulated leather bound. Price 50 cents in U.S.A., 75 cents elsewhere. Published by the Lincoln Electric Company, Cleveland, Ohio.

WITH THE *Manufacturers*

Graybar Appointments

David H. O'Brien has been appointed assistant general sales manager of the Graybar Electric Company.

Lloyd E. Luckman has been made acting manager of the St. Paul office, succeeding W. H. Holdorf upon his retirement from the company.

TO PLEASE CUSTOMERS

USE G-E QUALITY WIRING DEVICES

General Electric Company, Section D-0120
Appliance and Merchandise Dept., Bridgeport, Conn.

Sirs: Please send me a copy of the G-E Wiring Device Catalog.

Name.....

Firm..... Address.....

City..... State.....

For your own benefit as well as your customer's benefit choose wiring devices from the G-E line. They are easy to install and will give lasting dependable service. Your customers know that G-E products are quality products and therefore will be pleased when you use G-E wiring devices. Their use will help you to sell wiring jobs too.

The G-E line includes silent Sphinx Mercury Switches, Standard Switches completely insulated with Textolite, Standard Twin Convenience Outlets, many outlets for special purposes, plates, lampholders, circuit breakers, fuses, etc. Most switches, convenience outlets and plates are available in brown or ivory color.

For further information about G-E wiring devices see the nearest G-E Merchandise Distributor or mail the coupon for the G-E Wiring Device Catalog.

GENERAL ELECTRIC

"WHAT! YOU DON'T

KNOW WHO

Fortunately, not all buyers, bosses or customers are as explosive as the old boy in the corner.

But not knowing "who makes it" is *poor business* in any man's language. It costs money. And in most cases *it is inexcusable.* There are reference books to answer the "who makes it" question for every line of business.

In the electrical industry, it's Electrical Buyers Reference . . . for manufacturer, wholesaler, contractor, plant man . . . anyone buying, selling, or specifying electrical products.

This year, more than ever, Electrical Buyers Reference is a *must* item for electrical men. Because this year it's speed . . . rush . . . urgent. This year it's manufacturers whose delivery dates are six, twelve months ahead . . . it's contractors pushing new construction . . . it's plant men running two and even three shifts. Under present industrial conditions, time becomes doubly valuable.

Time lost in groping for product data is money out of *your* pocket—customers scratched from *your* ledger.

Use your copy of Electrical Buyers Reference. Use it every day, to answer every "who makes it" question. EBR is a time saver, a money saver, and a sales builder for every active electrical man. The more you use your copy, the more valuable it becomes.

ATTENTION MANUFACTURERS!

Forms for the 1941 edition of Electrical Buyers Reference close October 15th.

This year, EBR offers manufacturers a particularly productive channel of approach to the 30,000 key electrical men who use it. If you don't have full information already, we'll be glad to rush it to you.

MAKES IT?

WHAT EBR OFFERS ITS ADVERTISERS

- In 1940, there were two editions of Electrical Buyers Reference. For 1941, these have been combined into one enlarged volume which will be doubly useful to electrical buyers, doubly effective for manufacturers' "briefalogs".
- The 1941 edition will have a minimum distribution to thirty thousand key men in the electrical industry.
- These 30,000 men are the important buying factors among electrical contractors, large industrial plants, electrical utilities, electrical wholesalers, mines and railroads, electrical manufacturers, and electrical consultants. They are the men who specify the make and type of equipment used on electrical jobs.
- Electrical Buyers Reference offers these men thoroughly indexed and hence readily available information on the widest variety of products of over 3,000 manufacturers, compressed into a single, desk-size volume.
- To the manufacturer of electrical and allied equipment, this 1941 Edition offers a direct avenue of approach to these 30,000 active buyers. No other reference volume covers even a fraction of these men as completely and effectively.
- EBR further offers manufacturers the opportunity to deliver the impact of their sales messages at the psychological moment when the prospective buyer is most receptive, when he is not only interested in buying, but when he is about to buy.

ELECTRICAL BUYERS REFERENCE

A Unit of the McGraw-Hill Reference Service

330 WEST 42nd STREET, NEW YORK, N. Y.

SAVE MONEY

On Every Wiring Job!

Check

THE NEW 1940 CODE for Outstanding Advantages of OPEN WIRING SYSTEMS

Greater economy for open wiring systems is only one of the major advantages recognized by the new 1940 National Electrical Code. Take for example the comparative current carrying capacities of conductors in open wiring and all other types of wiring. To carry 350 amperes in open wiring on Type R conductor, you may use 350 MCM conductors, but to carry this same amperage on other than an open wiring system, it would be necessary to increase the size of the conductor to 900 MCM!

The savings on conductors are only too apparent. Now stop and consider the savings you make in installation time as well as the savings you effect in the elimination of other materials.

Not only has open wiring proved itself more economical but the safety factors which were good twenty-five years ago have survived the course of time and remained unchallenged by any other wiring system.

In open wiring systems you benefit to the greatest degree by its ready accessibility, ease of making extensions, alterations, tapping branch or feeder lines, and ease of inspection.

When you make wiring recommendations to your customers, keep in mind that not only will your customer get a better wiring job but you, too, can benefit by the greater economies and therefore greater Profits available.

SPECIFY

Open Wiring Systems

PORCELAIN PRODUCTS, INC.

FINDLAY, OHIO

In the News

[FROM PAGE 125]

New Name and Address

The Sterling Products Company of Detroit and Los Angeles is now the Sterling Tool Products Company of 363 East Ohio St., Chicago. C. B. Johnson, formerly sales manager of Sterling Products becomes vice-president and general manager of the new corporation.

•

Reliance Electric & Engineering Co. has opened a sales office in Houston, Texas with Frank A. Denison, Jr. as district manager. He will be succeeded there by Tinkham Veale.

•

Benjamin Electric Mfg. Co., held a meeting of the Board of Directors and elected Hoyt P. Steele vice-president in charge of research and engineering with headquarters at the general offices at Des Plaines, Illinois.

•

Weston Electrical Instrument Corporation, Newark, N. J. announces the appointment of Howard Peterson of the Peterson Company, 1921 Blake Street, Denver, as sales agent. Mr. Peterson succeeds the late J. W. Van de Grift.

•

W. B. Connor Engineering Corp., New York, announces the appointment of James E. Orr as advertising manager of its Dorex Division.

•

Westinghouse Electric & Manufacturing Co. has appointed Carl L. Westin as southwestern district service manager for the company. He will have headquarters in St. Louis, Mo.

•

The Harnischfeger Corporation of Milwaukee announces the appointment of C. E. White & Son, 18 West 22d Street, Indianapolis, as agents in Indiana. The agency will operate under the supervision of the Harnischfeger Chicago office.

•

Chicago Pneumatic Tool Company announces the appointment of P. J. Christy as manager of the Philadelphia office. He succeeds A. M. Brown, who has been transferred to Washington, D. C. as manager of the new branch recently opened there.

C. A. Diehl has been appointed manager of the Houston, Texas office.

Perfex Corporation, Milwaukee, has appointed George D. Kingsland as vice-president in charge of sales for its Eastern Division. He will be located at the New York office at 90 West Street.

•

The Turner Brass Works of Sycamore, Ill. announces the election of John Slezak as president of the company. He was formerly vice-president and general manager.

•

National Transformer Corp., Paterson, N. J. has appointed Russell W. Keiser as sales representative of the Cold Cathode Division. He has formed a new company, the Cold Cathode Illumination Co., 424 Peachtree St. N.E., Atlanta, Ga. and will cover the entire territory of the United States East of the Rockies.

•

Smoot-Holman Co., Inglewood, California has appointed Leonard A. Hobbs as general sales manager to succeed the late A. E. Clarke. He was formerly San Francisco district manager. Gale F. Thomas, formerly lighting specialist with the H. B. Squires Co., will succeed him as San Francisco district manager.

•

Bunting Brass & Bronze Company has put C. W. Sweeney in charge of its operations on the Pacific Coast. He will supervise the activities of the Bunting Sales Offices and Warehouses in Los Angeles, San Francisco and Seattle. Mr. Sweeney will be assisted by Walter Gardner, who has been in charge of the warehouse in San Francisco.

•

A. L. Powell Dies

Alvin L. Powell, supervising engineer of the lamp department of the General Electric Co., New York, died at his home in Glen Ridge, New Jersey, August 21, after an illness of several months.

Mr. Powell was an internationally known authority on illumination design and application. Upon his graduation from Columbia University, in 1910, he joined the engineering department of the Edison Lamp Works of General Electric Co. at Harrison, N. J., becoming manager of that department in 1925. When the Edison Lamp Works and National Lamp Works were consolidated into the incandescent lamp department of General Electric Co. and the Harrison group transferred to Nela Park, an eastern office of the Nela Park engineering department was organized and Mr. Powell placed in charge. He has been active in the Illuminating Engineering Society and served as president 1934-35.

Industrial Electrification and MAINTENANCE

POWER ECONOMICS

ECONOMICS plays a vital part in the industrial world. Sound economics may mean the difference between a profit or a loss on the annual statement. The cost of electrical energy and its intelligent use enters into the economic picture of industrial plant operation. Every kilowatt of energy consumed is charged to some portion of the plant operating overhead and thus finds its way into the ultimate market price of the product. Increased power costs—money paid for wasted power, unnecessarily high demand factors, poor power factor, overmotoring and the dozens of other smaller items where power is unwittingly wasted—all find their way into the production cost of the product. So it means less profit per item or a higher retail price. And with competition as keen as it is today, such a situation would have to be remedied within a comparatively short time. "Lower production cost"—that is the keynote of today's competitive industrial system.

The maintenance electrician has his own particular function in this campaign to reduce costs. It is his job to show where and how to "reduce power costs". While pursuing his duties as a maintenance electrician, while practicing preventive maintenance he can keep an eye open for power "leaks"—places where energy is being wasted. What are some of these "leaks"? Where are they to be found? How can they be discovered? Once found, how can they be remedied? These and many other questions are answered in the accompanying article on Reducing Power Costs.

Previous articles covered—

1. **Simplifying Electrical Maintenance**
2. **Preventive Maintenance of Distribution Systems**
3. **Preventive Maintenance of Electrical Equipment**
4. **Reducing Power Costs (this issue)**

Future articles will discuss—

5. **Maintaining Good Power Factor**
6. **Meeting Severe Service Conditions**
7. **Safety Protection for Electrical Operations**
8. **Increasing Flexibility of Electrical Service**
9. **Providing Adequate Capacity for Increased Demand**
10. **Extending Automatic Control**
11. **Electrifying Operations to Reduce Unit Costs**
12. **Methods for Handling Changeovers and Live Circuits**

Reducing Power Costs

EVERY manufacturer wants to cut operating expenses and one item always considered is electric power costs. This item is included in the price of the finished product and requires as careful study as the purchase of any raw material.

The plant electrical maintenance man, or an electrical contractor serving in the same capacity, is familiar with the processes and operations in the plant as well as the electrical equipment. It is one of his functional duties to make recommendations to the management when he sees a way to effect reductions in power costs.

Whether electric power is generated or purchased, he should consider the opportunities for reducing power costs, particularly those that exist beyond the switchboard bus. These include selection, installation, and operation of equipment, and, in the case of purchased power, rate structure.

Here are presented 10 major items on how to cut power costs and an additional 10 items for more specific cases.

1. STUDY POWER CONTRACT—For this discussion, the starting point will be where the total electric power for the plant is metered. An understanding of rates and the nature of the plant load will frequently show how power costs can be reduced. So, the first step is to study the power contract, to be familiar with the electrical terms and power rates, and to know the kind of meters used by the power company, how the meters operate, and what they measure.

Power costs in a very small plant are usually on the basis of an energy charge, that is, a charge is made for all or any part of a block or unit, and the price is reduced for succeeding blocks. Costs for large plants include an energy charge and a demand charge, the latter being the charge for the maximum power taken at any one time, such as for 15, 30, or 60 min., or according to connected horsepower.

The energy charge may be kept down by the economic use of power, and the demand charge may be reduced by keeping down peak loads. How these charges can be reduced will be explained more fully in the following paragraphs.

Power companies generally are glad to help their customers obtain the best rates for their loads. They can often make helpful suggestions on the use of power, and a consultation with them on plant power problems and costs is advantageous.

***SCHEDULED OPERATIONS** — Reduced power costs resulted from lower peak demands, where granite polishing machines (left) and sawing machines (right) were operated by the day and night shifts, respectively.*

2. KEEP DOWN PEAK DEMAND and by so doing generating equipment or incoming-power transformer equipment can be of a capacity that is suitable for the load, initial investment and carrying charges will be lower, equipment will be operated at a higher efficiency, and demand charges for electric power will be reduced.

Some methods for controlling peak demands are: (a) staggering production-machine starting in or by departments, (b) starting large motors before the plant starts operation, (c) starting motors without load, (d) staggering operation of large power-using apparatus, (e) scheduling production for a uniform use of power, (f) automatically or manually disconnecting some equipment when the load reaches a predetermined amount, (g) starting large power-using equipment early in the billing month instead of within a few days of end of month.

The following examples show what some plants have done to control peak demands and reduce demand charges.

A—In a granite-producing district in Minnesota, economical power use resulted from running polishing machines on day shifts and by doing sawing at night, with relatively small crews.

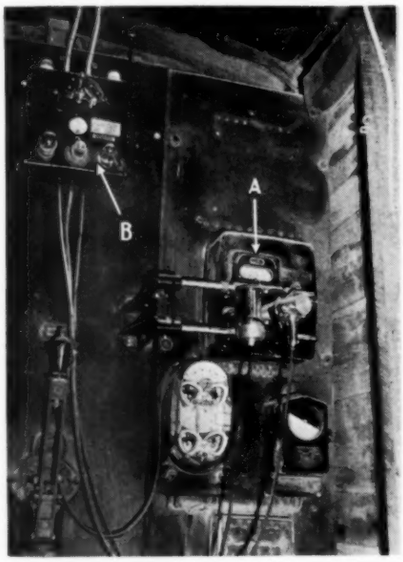
B—A demand limitator saved $50 a month in power costs for the Franklin Contracting Co., Newark, N. J. At the Great Notch plant each of four asphalt storage tanks (two 18,000-gal. and two 12,000-gal.) were equipped with three 3.2-kw. 440-volt immersion heaters. When the demand rises to 400 kw, the demand limitator, actuated by a phototube, cuts off the heating units and certain quarry equipment.

C—Large motors in a rubber mill are started and regulated by operators supplied by the electrical department. The operators also check controller functions and other intricate devices during each shift. These men have their instructions to regulate starting and heavy running loads to avoid building up excessive demand charges.

3. UTILIZATION OF POWER—Economic use of electric power begins with the proper application of electrical equipment. Power waste may result anywhere from the main transformers, through the distribution system, to the driving equipment and other power-consuming apparatus or devices.

A—*Transformers* are the most efficient of heavy electrical apparatus. The distribution type has an efficiency of approximately 98 per cent at full load, but at low loads the per cent power loss is really noticeable. One company was able to reduce transformer losses, and consequently power costs, by installing a 1,500-kva. transformer bank in addition to two 3,000-kva. banks originally in service. A study of plant requirements showed that one 3,000-kva. and the 1,500-kva. bank was sufficient for normal operation. Over week-ends the smaller bank carries the load. All other transformers are disconnected. Thus, they are able to increase the operating efficiency from 93 to 97.5 per cent.

B—*Distribution systems* may cause waste resulting from low power factor and low motor efficiency. A modern and flexible system, with proper size feeders for minimum voltage drop and



***DEMAND LIMITATOR** saved $50 a month in power costs. When the needle of the demand meter (A) swings up to a predetermined value, a photoelectric relay (B) disconnects certain equipment.*

with conveniently located outlets, facilitates equipment arrangements for special jobs and for filling small or emergency orders.

By using conductors one or two sizes larger instead of those with just enough capacity for the immediate load, even though the conductor cost is slightly increased, a permanent economic advantage is attained. This includes reduction in voltage drop and power loss (see table in Maintenance Guide Chart), and provision of adequate capacity for present and future use.

In addition, an adequate system may preclude the necessity of repowering for some applications, by bringing the driving equipment up to rating and high operating efficiency, and thereby getting proper utilization of electric power.

C—*Motors* quite often are underloaded, in which case the efficiency and power factor are low. This results in payment for power not properly used.

General-purpose motors having a service factor of 1.15 can carry a little overload without serious injury to the insulation. With a further increase in load, the efficiency drops rapidly, and the power factor having been slightly raised above the full-load value begins a sharp decline.

Low voltage at motor terminals is a cause of increased power consumption. The resultant effect is poor motor performance even though the power factor is slightly improved. Effect of voltage variation on motor operation is shown in a table in the Maintenance Guide Chart.

In some applications low-speed induction motors such as 514-rpm., are used. These motors have comparatively low efficiency and power factor, more weight, higher cost, and use more current per horsepower output than motors of higher speeds.

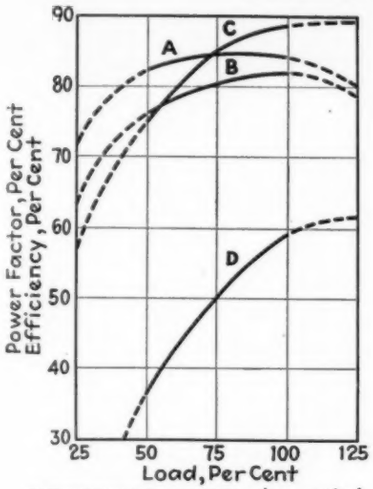
To reduce power costs some machines can be repowered, if practical, with high-speed (1,800-rpm.) motors that will operate near the full-load rating. For example: modern designed squirrel-cage, 1,800-rpm. motors have practically a flat efficiency curve between 75 and 100 per cent load. The curves in Figs. 1 and 2 of the Maintenance Guide Chart show the advantages of using high-speed motors and of operating motors as near as possible at their full-load rating.

D—*Lighting units* of the modern type can be used for illumination, as a means of cutting unnecessary waste of power. Savings in power can be made by (a) installing efficient units, (b) keeping them clean, (c) arranging them so that only those necessary will have to be turned on at any time, (d) operating lamps at rated voltage (see Maintenance Guide Chart), (e) painting ceiling and walls a color favorable to good lighting and (f) delegating responsibility to some one to switch off the lights when not needed.

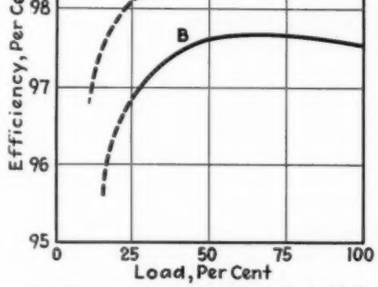
4. ESTABLISH STANDARDS—Power used in each department should be metered and charged to the respective departments. By departmental metering and a recording of the power used, standards may be set and comparisons of actual use made with the standards. In this manner abnormalities can be detected and corrected. The department head, being held accountable for the increased expense, will try to use less power where it can be done satisfactorily. The method of establishing standards may be applied also to processes and machines.

5. USE METERS—Where instruments or meters are not connected permanently to equipment, periodic load

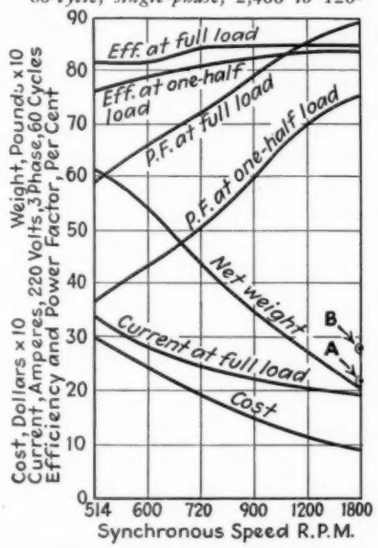
MAINTENANCE GUIDE CHART



PERFORMANCE CURVES *for typical 7½-hp, general-purpose, squirrel-cage motors. (A) and (B)—efficiency, (C) and (D)—power factor, for 1,800- and 514-rpm motors.*



PERFORMANCE CURVES *for typical 240-volt distribution transformers; (A)—200-kva, (B)—7½-kva. 60-cycle, single-phase, 2,400 to 120-*



CURVES *showing relative values for typical 7½-hp, general-purpose, squirrel-cage motors of various speeds. Points (A) and (B) show cost and weight, respectively, for a 7½-hp, 1800/507-rpm gear-motor with a 1.5 service factor for gears; full-load current and power factor are approximately the same as for the 1,800-rpm motors; over-all efficiency is slightly lower because gear efficiency is 95 per cent.*

Effect of Variation of Voltage on Motor Operation [1]

(Multiply indicated factor[2] [in table] by normal value [rated] to obtain corrected value)

GENERAL-PURPOSE A-C MOTORS

Per cent of normal rated voltage	Full-load speed	Starting and pull-in torque	Per cent slip	Starting current	Full-load current	Normal temp. rise	Full-load eff.	Full-load p.f.
120	1.02	1.45	0.70	1.25	0.90	0.88	Small increase	0.90
110	1.01	1.20	0.84	1.11	0.93	0.94	1.01	0.95
100	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
90	0.99	1.19	1.22	0.98	1.10	1.14	0.98	1.02

GENERAL-PURPOSE D-C MOTORS, Shunt- and Compound-wound

Per cent voltage	Full-load speed		Starting and pull-out torque	Full-load current	Normal temp. rise, field and armature	Full-load eff.
	Shunt	Comp.				
120	1.10	1.12	1.30	0.83	Very slight effect	Increase slightly
110	1.05	1.06	1.15	0.92	Very slight effect	Increase slightly
100	1.00	1.00	1.00	1.00	1.00	1.00
90	0.95	0.94	0.85	1.12	Very slight effect	Decrease slightly

[1] Courtesy Fairbanks, Morse & Co.

[2] Specific ratings may vary to some extent from these general values above and below 100% rated voltage.

Effect of Variation of Voltage on Lamp Performance [1]

(Multiply indicated factor [in table] by normal or rated value to obtain corrected value)

INCANDESCENT LAMPS

Socket voltage in per cent of rated lamp voltage	Watts consumed	Lumens of light	Lamp cost per 1,000 hr.	Cost [2] of light (lumen-hours)
110	1.17	1.36	3.50	0.987
105	1.08	1.18	1.91	0.967
100	1.00	1.00	1.00	1.000
95	0.925	0.84	0.50	1.065
90	0.85	0.70	0.24	1.150

[1] Courtesy Westinghouse Electric and Manufacturing Co.

[2] Applies only to 200-watt, 115-volt lamps at a list price of $0.30 and energy at $0.025 per kw.hr. For other lamps and other energy rates, the cost would be slightly different.

Voltage Drop and Power Loss for a 100-ft. Run

of Rubber-covered Cable when carrying a Load of 125 amp., 220 volts, 3 phase, 60 cycles, with reactance neglected.

Size of cond.		Conductor capacity, amp.	Resistance, ohms per 1,000 ft. at 50 C.	IR drop, volts	Power (I^2R) loss	
No.	Cir. mils				Watts	Kw-hr. per year (8 hr., 200 days)
1/0	105,500	125	0.1099	2.37	489	782
2/0	133,100	150	0.08712	1.88	387	619
3/0	167,800 [1]	180	0.06909	1.49	308	493

[1] Minimum size to use to meet NEC requirements if load is a 50-hp. motor.

tests should be made, and records kept of these tests. Here too, a standard can be set as outlined in a previous paragraph, and load comparisons made. Increased power requirements should be investigated and the cause remedied.

Misalignment and other causes of friction will increase loads rapidly and unexpectedly on some types of machines. An ammeter or wattmeter connected in the circuits to such machines show the operating condition.

If the load is under the control of an attendant, instruments should be provided so that the attendant can observe the operating conditions. Intelligent use of meters and instruments will indicate a way to prevent waste of power and to cut costs.

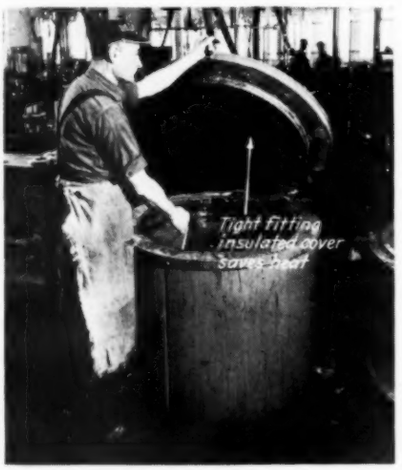
For example, a Midwestern plant made a saving by detecting wasted power, where a 3-hp. motor was used to drive a vacuum pump on a heating system. It had been in use for seven years when its performance was checked with a graphic wattmeter. The motor drew 5.4-kw.,a severe overload. An investigation showed that the windings were grounded, and that 4.5-kw. were wasted whenever the motor was on the line. This defect had wasted more than $4,000 worth of energy.

6. CORRECT POWER FACTOR—Power costs cover two kinds of power: one (expressed in kilowatts, kw.) which is converted into useful work, the other (expressed in reactive kilovolt-amperes, rkva.) which is used for magnetizing motors, high-reactance transformers for spot-welders, gaseous-tube lamps, and other a.c. equipment. An increase in magnetizing power or the rkva. causes a decrease in power factor. Most power contracts have a clause providing for a penalty charge for low power factor (usually less than 85 per cent), and some contracts provide for a "bonus" for maintaining the power factor above a specified percentage.

Although power factor below unity (or 100 per cent) is a natural occurrence on a.c. systems, many plants can reduce power costs by power factor correction. Improvement in power factor can be made (a) by using motors that will operate at or near full load, (b) by using motors of higher speeds, preferably 900 rpm. and above, (c) by connecting capacitors in the circuits near the equipment causing poor power factor, (d) by using motors with built-in capacitors, and (e) by using synchronous motors on drives requiring 25 hp. or more and operating continuously during the work shift. This subject on correcting power factor will be expanded in a forthcoming article.

7. CHECK MECHANICAL TRANSMISSION—Minimizing losses in mechanical transmission of power is an important step in reducing power costs. Some ways of reducing losses are: (a) maintaining alignment of line shafts, belts, gears, chains, and tension of belts and chains; (b) using anti-friction bearings and proper lubrication; (c) selecting a variable-speed device for speed adjustment where it is required.

Group drives often permit operating the motor near its rated load, resulting in operation at higher efficiency and



***HEAT INSULATION** on this electrically heated vat keeps the cleaning solution at 190 F, with power on only a fraction of the time.*

power factor. However, this method of drive must be balanced against group shut-downs and loss of flexible operation as compared with individual machine drive.

As an example on rearrangement of drives for reducing power costs, a Chicago paint and varnish plant in a three-story building had all machines driven from several line shafts and a single motor in the basement. Group drives on each floor were sectionalized for certain machines, each section being driven by a separate motor. Individual motor drives were installed for other machines. The arrangement permits operation of departments and sections according to varying demands, without having the entire system in operation.

Individual machine drives usually require a reduction in motor speed, involving the use of belts, chains, or gears, built-in or separate speed reducers, or variable-speed devices. Here again transmission equipment must be checked for possible losses.

Where motors can be direct-connected to line shafts or machines, it is preferable, wherever practical, to use a high-speed motor with an integral gear rather than one with a low speed corresponding to the driven-shaft speed. From a performance standpoint, using a high-speed motor with built-in gears results in higher motor efficiency and power factor. These and other advantages are shown in Fig. 2 in the Maintenance Guide Chart.

8. STOP LEAKS—Losses in power can result from leaking air and water lines and air- and water-using equipment. Compressors and pumps should be maintained in good operating condition. A pump may appear to be running satisfactorily but a check may show that it is operating at an efficiency of 40 per cent instead of 80 per cent. The difference will be shown in the power bill. One plant reconditioned a compressed-air system and eliminated wastes, which permitted shutting down one of two compressors formerly required.

9. ELIMINATE SMALL WASTES—The Scotchman says "Many a mickle makes a muckle." A saving in small wastes becomes a large amount at the end of the year.

Electric power is frequently wasted when motors are allowed to run without doing any useful work. This happens when a machine or the motor is running idle, also when the motor is run while work is being set up or taken down. As another instance, the operator may go to the tool room or elsewhere in the shop and allow the motor to run, anticipating that he will return shortly but is detained. In addition, leaving a machine unattended while the motor is running is bad practice and should be prohibited.

Stop buttons readily accessible to the operator will enable him to stop the machine. Also a signal light will serve as a reminder that the motor is connected and running.

Some of the smaller power wastes that can be eliminated are: (a) unnecessary use of, or neglect to turn off, lights; (b) thoughtless waste of water, steam, and compressed air; (c) transformer banks not needed but left connected to the line; (d) failure to cover plating baths to retain heat at night. Elimination of minor wastes can be brought about by education, regarding any form of power as a tool to be used economically and intelligently, obtaining united employee co-operation, making a check of such wastes, and making known the results.

10. PLAN PREVENTIVE MAINTENANCE—After electrical equipment has been selected and installed, preventive maintenance aids in reduc-

[Continued on page 134]

Not a Kick in a Mile of it!
CLARK KICKLESS CABLE showing 720° Torsional Hand Twist in Direction Opposite Helical Winding
CLARK KICKLESS CABLE in Normal Position—No Torsional Twist
CLARK KICKLESS CABLE showing 450° Hand Twist in Same Direction as Helical Winding

• No Sir! There's no kick in Clark Kickless Cable—a water cooled electrical connection between the secondary taps of a welder transformer and a portable welder gun. The interweaving of cables of opposite polarity around a central soft rubber core, with a corrugated live rubber spacer, causes reactances to neutralize each other. This neutralization effectively eliminates the "kick" or jerking apart that characterizes the use of two separate cables.

And this "Kickless" quality helps production... because the gun can be placed and held accurately... the operator has no "kick fatigue" to overcome... more amperage is delivered at the tips...uniform amperage is delivered at all times.

Flexible? Yes, sir! The cable diameter is sufficiently small to allow bending into arcs of short radii. The cables are helically wound, and just a simple twist of the wrist permits torsional flexion of 450° from normal in the direction of the helical winding, and 720° from normal in the direction opposite to the helical winding. (See the chalk line on the special made, cord-reinforced, rubber tube in the pictures.)

Such twisting is visible evidence that torsional pliancy and bending sufficient for practically every welder gun application are found in Clark Kickless Cable.

FURNISHED IN TWO SIZES

400 M—equivalent to separate cables of 400,000 c. m.
750 M—equivalent to separate cables of 750,000 c. m.

WRITE FOR BULLETIN 7777 FOR COMPLETE DETAILS

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

QUICK RELIEF *for Crippled Motors*

Round up those sick motors loafing in your workrooms.
Install some new Bunting Bearings.
Give quick, easy, inexpensive relief.
The Bunting wholesaler can supply you.

● Most often a new bearing is the only thing needed to make an idle electric motor do its part in the big production program now gathering speed all over America.

Bunting Bronze Bearings for all makes of motors from 1/50 hp to 100 hp are available from stock. They are accurately made to the original specifications of the motor manufacturer. They are instantly available from electrical wholesalers everywhere.

The Bunting catalog makes selection and ordering easy. Write for your copy. . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

This New RIDGID Tri-Stand Vise Really Saves you work...

LEGS fold up snug to go where your work is. Sets up rigid, hard to knock over—ceiling brace and screw-down feet, if you want to use them. Special malleable frame is a whole work bench—lots of room for oil cans, dope pots; slots to hang a flock of tools handy; pipe rest and three benders that won't collapse your pipe. Chain or yoke, with highest quality tool steel jaws. An outstanding value in convenience, built to take the punishment. Saves you work *AND* money. Buy from your Supply House.

New RIDGID Chain Tri-Stand. Capacity 4"

THE RIDGE TOOL CO.
ELYRIA, OHIO

RIDGID PIPE TOOLS

ing power costs. Here are five points:

A—Arrange for scheduled inspection and routine maintenance practices. These will help determine where excess power is consumed.

B—Make periodic tests to determine conditions that can be observed during scheduled inspection. Keep a written record of all tests.

C—Use modern, more efficient equipment to replace that which is obsolete and worn.

D—Have available a stock of electrical supplies, motor and control parts, spare motor and control units, and various auxiliary devices, so that worn parts and equipment can be replaced, to minimize abnormal use of power. Also have a local source for authorized renewal parts.

E—Restrict the starting and operating of machines to members of the electrical maintenance department, whenever necessary, to keep down demand peaks as well as for economy in energy.

Another example shows how use of modern equipment has a bearing on power costs. Previously d.c. power was used throughout a plant. Maintenance costs increased because of the condition of the d.c. equipment. Also a.c. power was needed for additional equipment. So a.c. service lines were run and two 150-kw. rotary converters were installed. As a result annual overall savings of 25 to 35 per cent in power costs were obtained by replacing worn d.c. motors with new a.c. motors, by installing new welding equipment, and by shutting down the d.c. generating plant.

11. OTHER WAYS. The purpose of this discussion is to cite some practical solutions for conditions that exist in most plants. However, in thinking about the problem with respect to individual situations, remember—

A—Use special-purpose motors only for drives for which they are designed.

B—Whenever possible use medium- and large-size synchronous motors instead of the induction type, especially where low speeds are involved.

C—Replace old inefficient motors with modern motors of the proper rating; do the same with control.

D—Install power-factor corrective equipment, synchronous motors or capacitors.

E—Simplify mechanical drives.

F—Use anti-friction bearings on line shafts and other equipment.

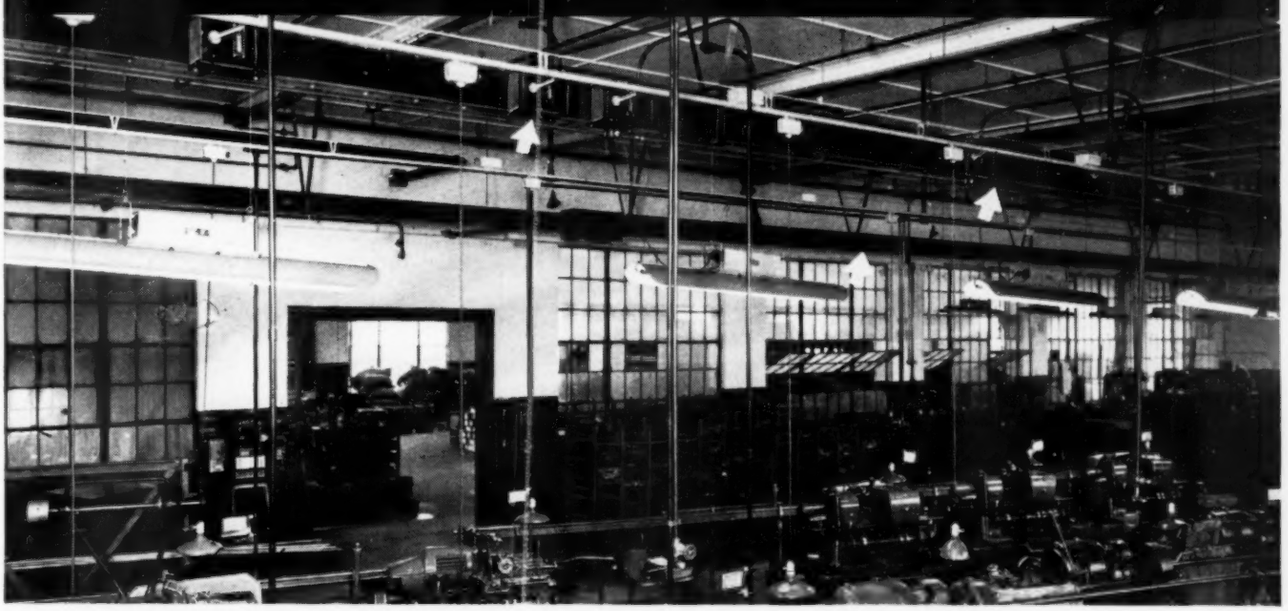
G—Study processes with a view to using less power.

H—See that electrical equipment is operated at rated voltage.

I—Reduce copper losses by keeping feeders as short as possible.

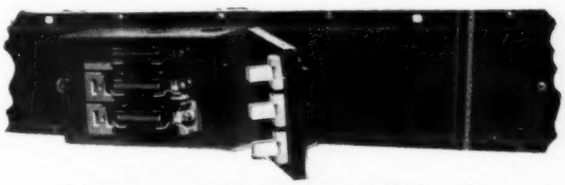
J—Install distribution transformers as near as possible to the load centers.

The derating of the larger size Cables under the new Code gives further emphasis to the advantages of **BULL DOG "Plug-in" BUSTRIBUTION DUCT**



An Industrial Installation having BUStribution DUCT for flexible power circuits and Universal Trol-E-Duct supporting and feeding fluorescent units for flexible lighting.

BULL DOG BUSTRIBUTION DUCT—the Modern Enclosed Busbar System of flexible electrical distribution should now prove more popular than ever and you will want to learn more about this flexible, convenient and economical system that is rapidly replacing old-fashioned methods of electrical distribution.



Close-up of a BUStribution DUCT section with Fusible "Plug"

A new 48 page Bulletin (No. 403) entitled—FLEXIBLE LIGHT AND POWER CIRCUITS FOR INDUSTRIAL PLANTS AND COMMERCIAL BUILDINGS—has just been received from our printer. It is full of interesting illustrations with complete engineering information regarding Lay-outs, Methods of Estimating, Symbols for Estimators, etc., etc.

Write for copies of Bulletins 403 and 386 on BUStribution SYSTEMS for flexible Light and Power Circuits

BULL DOG ELECTRIC PRODUCTS CO.

Originators of Flexible Electrical Distribution Systems

DETROIT, MICHIGAN

MANUFACTURERS OF Vacu-Break Safety Switches, Panelboards, Switchboards, Duct Systems—FOR LIGHT & POWER

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Constructed From Fine Sheet Steel . . . making stronger, neater and more durable connections than ever. Impossible to split the tube end because of inbuilt tensile strength of the sheet steel.

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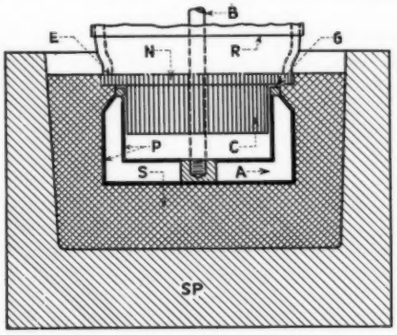
New Method of Soldering Commutators

By P. L. Lenz

General Foreman, Generator Division, Westinghouse Electric and Manufacturing Company

Commutators are commonly soldered in repair shops and manufacturing plants, by the process known as "pot soldering." In this process one or more solder pots are employed. They are connected to interchangeable rings in the form of a trough, and so arranged that when plungers are forced in the pots, molten solder is forced out into the ring trough. For any particular diameter, a ring is chosen to fit the



***SOLDERING COMMUTATORS** with simplified equipment. (A) Air space. (B) Bolt for clamping cover in place on packing and commutator neck. (C) Commutator. (G) Asbestos packing to keep solder from commutator. (E) Leads to be dipped in solder. (N) Commutator neck. (P) Circular cover to protect commutator from heat of solder. (R) Rotor. (S) Solder. (SP) Solder pot.*

commutator which is set down through it. Asbestos gaskets prevent solder from running down on the bars and confine it to the commutator neck which serves, when in position, as the innerwall of the trough. By this method rather eleborate equipment with rings of different diameters is necessitated and has a factory cost of from $650 to $2,500.

A new method does not require such expensive equipment and performs the task equally satisfactorily. A bell-shaped, double-wall container is placed over the commutator and clamped tightly against the commutator neck. The air space between the inner and outer walls acts as an insulator and protects the commutator face against excessive heat. An asbestos gasket placed between the protector and the connector prevents solder from coming into contact with the commutator bars. The armature to be soldered is then immersed to the depth of the commutator neck in an ordinary solder pot. After the solder has penetrated the wire space slots, the bell-shaped protector is removed and needs no further cleaning.

This method and apparatus have been successfully proven on commutators of

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NO, FAIRBANKS-MORSE is not the only electric-motor builder who casts rotor and squirrel cage winding into one piece centrifugally.

But, only Fairbanks-Morse makes a centrifugally cast rotor with the winding of COPPER.

Of course it's more difficult. It took a great deal of time and money to learn how to perfect the means of production.

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Copper has better electrical conductivity. *Copper* has better thermal characteristics.

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various sizes. The advantage is in the original cost and the simplicity of the apparatus (see accompanying illustration). The apparatus required is nothing more than a protector and has a factory cost of from $5.00 to $25.00, depending upon size. This new method of soldering commutators should be especially attractive to service departments and repair shops, where varying shapes in small quantities are constantly being handled. However, it must be remembered that no matter what kind of apparatus is being used, a number of different sizes are needed.

Application of Magnetic Pulleys

Where bulk material is being handled by a conveyor and magnetic particles must be removed, a magnetic pulley or separator is a valuable asset. This pulley generally displaces the head pulley on a belt conveyor. Its size and diameter are usually determined by the capacity handled, speed of the conveyor, and depth of material.

In general, magnetic pulleys have a maximum speed of 38 rpm, hence its diameter is dependent on the width of the belt and the conveyor speed (feet per minute).

Any pulley speed greater than 38 rpm. tends to throw, rather than gently cascade, the material over the brow of the pulley. The increased speed tends to carry the finer magnetic particles beyond the range of the pulley, reducing separation.

Any speed less than 38 rpm. permits greater depth of material on the belt because the material breaks more slowly over the pulley.

Depending on materials handled, the depth of the material when the pulley is operating at 19 rpm. may be double that of a similar diameter pulley operating at 38 rpm.

Electric Heat Supplants Steam For Processes

Operating expense for the National Acme Company of Cleveland, manufacturer of a variety of machine products made of brass, steel, and other materials, was reduced through the application of electric heating devices for hardening, pickling, and drying.

The processes had previously been supplied heat from a large boiler plant maintained by the company. Operation of this boiler plant through the summer months, when heat was not required for general heating purposes, entailed considerable expense and made the cost of some of the processes rather high. The steam boiler was

necessary for supplying heat to only four locations in the processes.

A comparative study proved that electric heat would not only do the job efficiently, but also eliminate the necessity of maintaining operation of the steam boiler throughout the summer months. General Electric heating units were applied to all the processes.

In the hardening room a large cleaning tank and an oil quench tank utilized steam during the winter months for heating. It was found that about 15-kw. of immersion type heaters would supply the amount of heat necessary for this operation.

Parts from the hardening room go into another room where the manufacturer has a pickling tank for removing scale from the steel parts, as well as other tanks for cleaning and coloring the brass parts. The latter operation is done in a group of four tanks. The brass parts are first washed in a soda solution, then rinsed, then dipped in an acid solution to remove stains, then rinsed and dried. All of these tanks, of course, require heat, which is now supplied by immersion heaters totalling 25-kw. No automatic controls were required.

After the parts have been through the cleaning process they are put into the dryer. Here also the change-over from steam to electric heat proved easy to solve. A small tank was lined with strip heaters. From this tank a pipeline leads to another tank equipped with a motor-driven centrifugal dryer. As the machine rotates, a blast of hot air from the strip heaters is blown over the parts with entirely satisfactory results. Strip heaters totalling 5-kw. were found to give sufficient heat.

There were only two other locations in the plant where steam was required for heating during the summer period, and these two were fairly easy to solve. In the laboratory a hot water tank was required for various uses. A 2-kw. heater was supplied here. In the other location, the steam tables in the cafeteria, two 5-kw. heaters were installed.

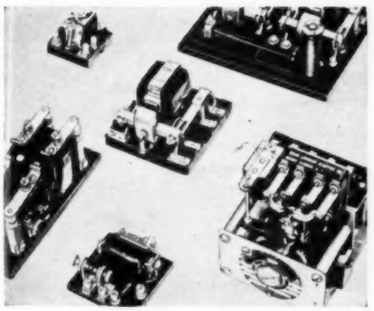
Total cost of this change-over, including operating cost, was small in comparison to the cost of summer operation of the steam plant.

Short Circuit Trouble On Shunt Fields

A simple method by which the maintenance man can test the field circuit of a d.c. shunt wound motor to locate short circuit faults is outlined here. A conventional test lamp is the only piece of testing equipment necessary.

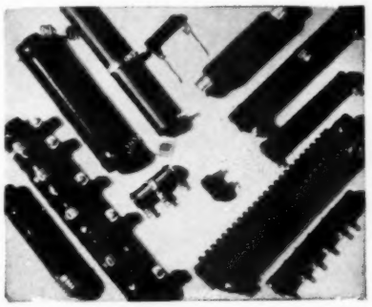
Step by step procedure to determine the location of a "short" in the motor field—

RELAYS



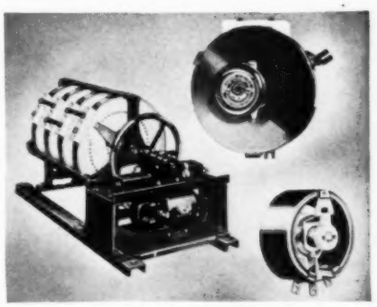
The Ward Leonard Line of Relays comprises light, intermediate and heavy duty, sensitive, transfer and time delay types for every application. They all have crisp action, are dependable and durable yet consume but little current. Various Ward Leonard Relays are described in "W.L. Relay Bulletins."

RESISTORS



More than 10,000 Electrical and Industrial Engineers are using Ward Leonard Data Sheets as Resistor reference guides. Ward Leonard Resistors cover a wide range of sizes, ratings, enclosures and terminals. You will most likely find your "special" is a Ward Leonard "standard." Send for "W.L. Resistor Bulletins."

RHEOSTATS



Ward Leonard Line of Rheostats includes everything from small types for fractional H.P. motors to the largest multiple units to control heavy current requirements. Ward Leonard Rheostat Bulletins fully describe types, drives, mountings and accessories. The Ward Leonard Line is complete. Send for "W.L. Rheostat Bulletins."

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PAINE
ANCHOR
FOR EVERY TYPE
OF INSTALLATION
IN SOLID MATERIAL

Fig. 910 Fig. 900

PAINE
LEAD
ANCHORS

Here's a time and labor-saving anchor — made from a special lead mix that assures secure anchorage for all types of electrical equipment in solid walls, floors and ceilings — including Brick, Cement, Tile, Stone and Marble. In addition, it will not fracture the most fragile material. Available in all standard sizes ¼" to ½" diam.

PAINE SINGLE
MACHINE BOLT SHIELDS

Fig. 970

A dependable and durable anchor that gives strong wearing at all points when expanded. Has powerful interlocking construction that makes it practically one-piece. Made for all standard Machine Bolts.

PAINE MALLEABLE
LAG SCREW SHIELDS

MALLEABLE SHIELD

Easily, quickly and permanently set into holes made in concrete. Shields have deep accurate threads designed to fit any square or flattened head lag screw. Lag screws never strip or freeze.

PAINE SPRING WING
TOGGLE BOLTS

Fig. 123

Provide unusually secure anchorage in hollow walls, floors, and ceilings. Wings slip easily through the smallest opening without catching or jamming and automatically spread to anchoring position assuring dependable anchorage where either wing can be used.

FREE—NEW PAINE Toggle Bolt Clamp—that takes all of the headaches out of each installation and cuts installation time ⅓. Simply send name of your Toggle Bolt Supplier and Clamp will be mailed without cost.

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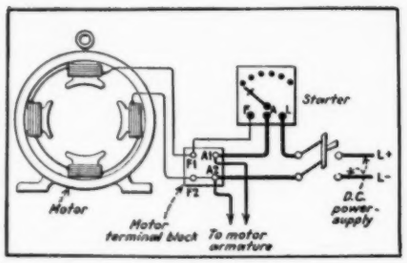
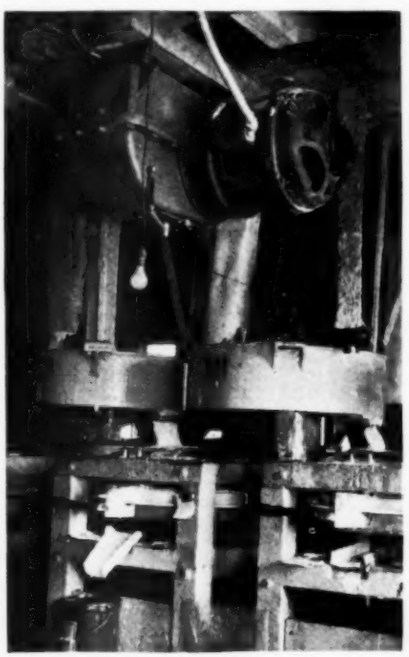


TYPICAL CONNECTIONS for a shunt-wound motor and manual starter.

1. Open line switch.
2. Maintain shunt field connections.
3. Disconnect the armature lead at the starting box.
4. Close line switch.
5. Move the starting arm to the full running position.
6. Connect the test lamp across the terminals of each field coil.
   a. If the glow of the lamp is dimmer at one set of terminals, than when the lamp was connected across the terminals of the other field coils, this particular coil is the "shorted one."

Gearmotor for Drive

When the mixer drives were modernized in a paint manufacturer's plant, a gearmotor replaced a steam-engine



***GEARMOTOR**, ceiling mounted, direct connected to line shaft for paint mixers. (Westinghouse photo)*

drive for a line shaft. In order to make the modernization as economical as possible, the output shaft of the gearmotor was located at the same spot that the old line shaft had been. To accommodate this, the entire gearmotor assembly was literally hung from the ceiling.

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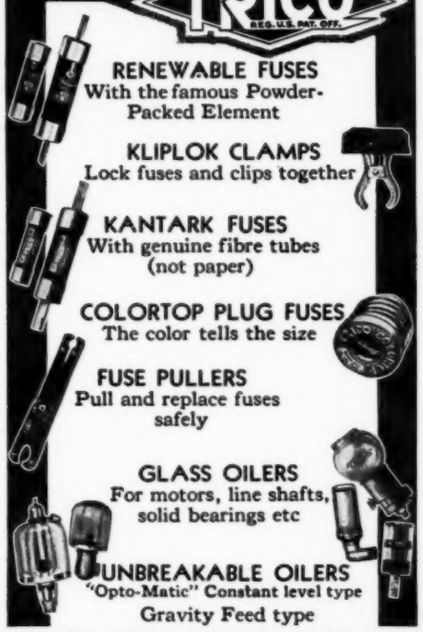

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the Easy Way

The old arm and hammer method is slow, hard and expensive. It's quick and easy with the Wodack "Do-All" Combination Electric Hammer and Drill. 2 tools in 1. Drills concrete to 1⅜" and metal to ⅜" diameter. Cuts the cost of setting expansion anchors. Widely used by electrical contractors and industrial maintenance departments. Universal motor 110 or 220 V. Ask for Bulletin No. 400.

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DASHBOARD CONTROL

PRESS A BUTTON ON THE DASH . . . GARAGE DOOR OPENS.

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1940 ELECTRICAL BUYERS REFERENCE
Doors and Operators, Inc.
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More Gossip

Vancouver Club Elects

George Knowles, sales engineer of the Canadian Telephone & Supplies Ltd., is the new president of the Vancouver Electric Club. The other officers are: vice-president, B. W. Markham, Northern Electric Co., Ltd.; honorary secretary, R. A. Benson, Canada Wire & Cable Co., Ltd.; honorary treasurer, F. Lightfoot, Northern Electric Co., Ltd.

Inspector for Elkhorn, Wisc.

The city council of Elkhorn, Wisc., has adopted an ordinance creating the office of electrical inspector and providing for the establishment of a board of electrical examiners. The measure, which is designed to regulate electrician licensing and electrical installation practices, became effective Sept. 22.

COMPLETE DISPLAY of all types of lighting fixtures is a feature of the Southern Electric Co., Galveston, Texas. A. G. Bernheim reports that fixture sales and installation comprises a large portion of his contracting business.

Schultz League President

Clarence Schultz was elected as new president of the Appleton Electric League at the September meeting. The other officers elected were: Erwin Reimer, vice-president; Louis Luebke, secretary-treasurer and Fred Kositzke, sergeant-at-arms.

League Moves

The Electric League of Indianapolis, Inc., moved on Sept. 1 into its new headquarters in Room 521, Chamber of Commerce Building. The new quarters offer better facilities for private committee meetings and conferences.

Another item of which the members are justly proud is the receipt of the NEMA Certificate of Approval, the award of which signifies the endorsement of the League by the National Electrical Manufacturers Association.

INVESTIGATE G-E QUALITY CONDUIT PRODUCTS BEFORE YOU BUY!

General Electric Company
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Bridgeport, Conn.

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For ease of installation, customer satisfaction, and freedom from service calls, due to breakdown of materials, select G-E Conduit Products—G-E White Rigid Conduit or G-E Electrical Metallic Tubing or G-E BX Armored Cable or G-E BraidX. All of these materials are made according to rigid specifications and are leaders in their class.

G-E White Rigid Conduit provides lasting protection for wiring systems. It is made of mild "rimmed" steel, hot-dipped galvanized and Glyptal-coated inside and out. It is resistant to heat, flame, gas, acids, alkalies and moisture.

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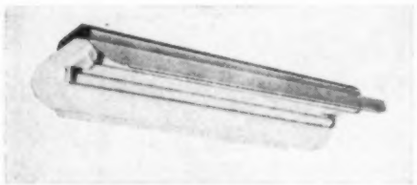
For further information see the nearest G-E Merchandise Distributor or send the coupon above for a G-E Conduit Products Catalog.

GENERAL ELECTRIC

EQUIPMENT News

Lighting Unit

A new open end twin-lamp fluorescent luminaire designed for general or supplementary lighting of low bay industrial areas. Uses 40-watt, 48-inch mazda Type F white or daylight fluorescent lamps. Available only in spread distribution style for operation on 110-125, 199-216, and 220-250 volts, 60 cycle a.c. Unit consists of hood, reflector, lamp holders, starting device, and ballast equipment. Arranged for rigid or flexible conduit, or chain suspension mounting; Levolier switches may be installed if desired. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



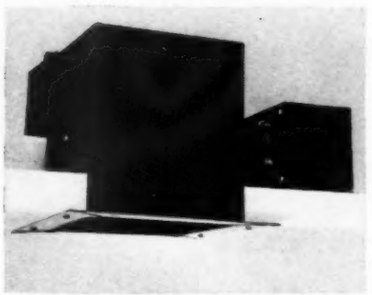
WESTINGHOUSE LUMINAIRE

■

Time Switch

A time switch used to automatically open and close an electric circuit. Has self-starting synchronous motor, slow speed. Switch may be operated by hand at any time, without disturbing time set to operate. Units are enclosed in steel box, with twistouts in bottom and sides and room for conduit or cable connection. Case is provided with top and bottom hangers. Available in one and two pole, 35 amp., 110- and 220-volts. Northwestern Clock Co., Omaha, Nebraska.

NORTHWESTERN TIME SWITCH

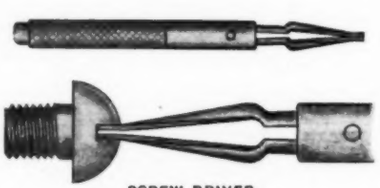


CONTINENTAL BLACK LIGHT

Black Lights

These black lights have been developed for activating fluorescent aisle carpeting. Uses 100 watt tubular mazda AH-4 mercury lamp as the source of "near" ultraviolet energy. Beam pattern is long, narrow and sharp in cut-off. Beam width is adjustable so that black light may be confined to carpeting in aisles of any normal width, with no spill over adjacent areas. Two models available—one for flush mounting in suspended ceilings and the other for attached mounting to ceilings. Both operate on 110-125-volt, 60 cycle, a.c. Continental Lithograph Corporation, 72d St. at St. Clair Ave., Cleveland, Ohio.

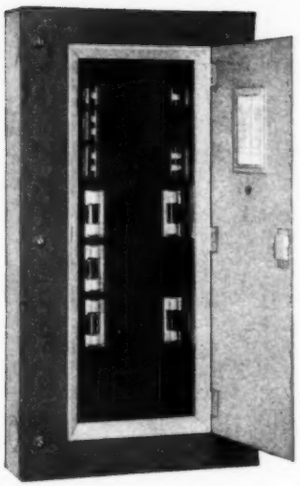
■



SCREW DRIVER

Tool

A new screw-gripping screw driver for insertion and removal of screws in both accessible and inaccessible locations. To operate push screw on to expanding bits which cede into handle as they expand. To restore the tool to screw-engaging condition, press release rod which extends through tool against hand or bench. Available in two sizes and in varying lengths. H. J. J. Company, 1946 Franklin St., Oakland, Calif.



SQUARE D PANELBOARD

Panelboard

New type MH multi-breaker distribution panelboard has been developed. Branch breakers are furnished in 15 to 100 ampere capacities—1, 2 or 3 poles, for 115- and 230-volt, single phase and 3 phase a.c. systems. All breakers used in these panels are common trip, and suitable for use on ungrounded systems. Single phasing of motors protected by these circuits is prevented. Panels are dead front. Square D Company, 6060 Rivard St., Detroit, Mich.

■

Motor

A new fractional-horsepower capacitor motor for jet pumps has been developed. It has through ventilation and built-in capacitor in end shield. Openings in pulley-end end shield permit cool air to be forced through stator. Motor has aluminum rotor; ball bearings for vertical operation and thermal overload protection. Protection is provided by overload protective switch mounted in end shield which protects it from damaging overloads and automatically resets when motor cools. Available in sizes from 1/6 to 1 horsepower, 3450 rpm. General Electric Co., Schenectady, N. Y.

G-E JET PUMP MOTOR

G-E Tapes

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G-E Friction Tapes—3 Types

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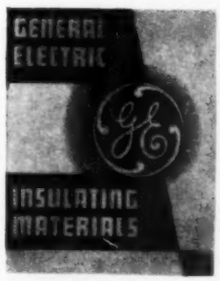
G-E Surgical Webbings

G-E Stay-Bindings

The complete line of high quality General Electric Tapes is fully described in the new General Electric Insulating Materials Catalog. If you would like a copy, write to Section M-0120, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.



. . . The General Electric line of Tapes is truly COMPLETE!

GENERAL ELECTRIC

NEW

MONARCH MON-O-LAG RENEWABLE FUSES

for

Better Protection

and

Low Fuse Maintenance Cost

Stocks in twenty strategic locations throughout the country for wholesaler service

MON-O-LAG FEATURE

Prevents needless opening of circuits on harmless overload surges

ULTRA MODERN

in ruggedness, simplicity of construction, and ease of renewal

MONARCH FUSE COMPANY, INC.
Jamestown, N. Y.
1909 Established 1909

•CAPACITORS•

• It's easy to service electric refrigerator motors of the capacitor-start type, the *Aerovox Way*. Aerovox provides up-to-the-minute listings of required *exact-duplicate* and of *universal* replacements for all types.

And in the absence of motor name-plate or other identification, you can use the *Aerovox Capacitor Selector* to determine correct and safe capacity. That capacity is immediately provided by the *Aerovox Emergency Unit*, by plugging in the required sections.

Ask . . .

Your jobber will gladly show you the Aerovox motor-starting capacitor line. Ask for latest catalog—or write us direct.

AEROVOX
NEW BEDFORD MASS.

EQUIPMENT NEWS

[FROM PAGE 142]

Instrument

This Knopp load analyzer is designed for making power factor and related measurements. It has a wide range which permits measurement of power factor, watts and volts on loads of a few watts up to as high as 24,000-48,000 watts. Power factor is read directly by turning a knob. Watts and volts are read by means of same measuring element. Available in five different models with eight current ranges from .5 to 100 amperes and potential ranges from 120- to 480-volts. Power factor measurements can be made from 10 per cent lag to 85 per cent lead. Wattages from 10 to 48,000 watts are read from a proportional linear scale. Electrical Facilities, Inc., 4224 Holden St., Oakland, Calif.

KNOPP LOAD ANALYZER

Lighting Fixture

A new flourescent fixture called Utility Flu-O-Flector. Reflector is removed by unscrewing two large knurled nuts. With extra reflectors on hand, maintenance crews take down dirty reflectors and substitute ones that have been cleaned on floor or at bench. It is made of aluminum, processed Alzak. Outer housing is heavy gauge steel, galvanic rust-protected. Power factor lamp control and starter switches are secured in housing. Edwin F. Guth Co., 2615 Washington Ave., St. Louis, Mo.

GUTH FLUORESCENT FIXTURE

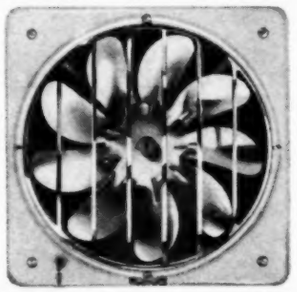
MARTIN *Portable* VISE STAND and PIPE BENDER

Sets up in a half minute and *stands without hitching*

Here is a genuine time-saver for cutting or threading conduit up to 2½". Bending capacity ¾". Carry the Martin Vise Stand and Pipe Bender on the job — it's *really* portable. Write for complete details and prices.

Also made in a larger size—4½" vise capacity with 1" bender capacity.

H. P. MARTIN & SONS
800 W. 12th St. Owensboro, Ky.



MODEL 50 . . . . . $25.00
Other Models $19.75 and $32.00.

New **VENTROLA** Ventilating Fans
253 E. 9 Mile Road, Ferndale (Detroit) Mich.

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for technical and business men

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Ratchet and Threaders

Five new ratchet and three-way threaders for small pipe are now available. Nos. OOR, OR and 11R thread ⅛- to 1¼-in. pipe. Separate sets of semi-high-speed tool steel chaser dies are accurately cut, easily removed for regrinding. In No. OOR, die heads are locked in or removed by a pull of ratchet knob. In Nos. OR and 11R die heads push out for changing, snap into ratchet ring from either side. Series Nos. 30A and 31A three-way threaders for small pipe have same features as above series. They have double ball-end handles and thread pipe from ⅜- to 1-in. Ridge Tool Company, Elyria, Ohio.

No. OR and 11R RIDGID Ratchet Threaders for ⅛" to 1¼" pipe.

No. 30-A and 31-A 3-way Ratchet Threaders for ⅛" to 1" pipe.

RIDGE TOOL RATCHET AND THREADER

■

Contactor

A new enclosed type DN multi-pole contactor, in size 00. Available in ratings up to 10 amperes, 600-volts, a.c. and may contain as many as eight poles in any combination of normally open and closed contacts required for complicated control systems. Enclosure is made of black enamel sheet steel and has snap cover. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

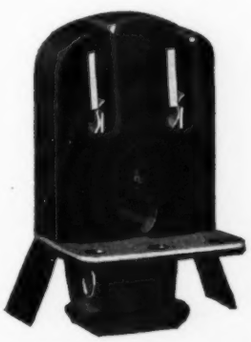
WESTINGHOUSE CONTACTOR

BARCLAY TRANSFER SWITCH

Automatic Alternator

An automatic alternator for duplex pumping equipment has been developed. It automatically cuts in idle pump under flood conditions or in event one pump is out of order, the other is cut in for each pumping operation. For use on sump pumps, bilge pumps, condensation pumps, sewage pumps. Consists of fully housed controller unit with slotted operating lever. Lever takes all sizes of float rods and cables, so device can be applied to existing installations as well as new equipment. For operation on a.c. or d.c. Unit is mounted in weatherproof, cast aluminum housing, and all internal parts are rustproof. Barclay Control Co., 5152 Division St., Chicago, Illinois.

■



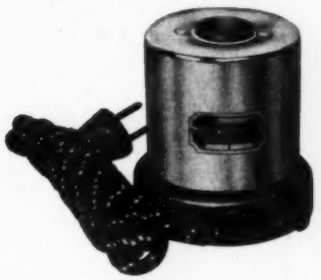
BRYANT LAMPHOLDER

Lampholder

Some of the features of this new fluorescent lampholder are "J" slot principle; straight push contacting; bronze contacts backed by steel pressure spring; fibre shield provides insulating flaps for terminals after wiring; mounting hole countersunk for single screw mounting against flat surface; three tapped holes in metal bracket; binding screws recessed. For use with T8-1-in. diameter lamps. Bryant Electric Co., Bridgeport, Conn.

Solder Pot

Cast iron solder melting pot holds 1¼ ounces of 50/50 solder. Inside diameter ¾-in. and depth ¾-in. It is insulated against loss of heat and has adjustable thermostatic heat control. Can be supplied for use on either a.c. and d.c. current. Current consumption is 75 watts. Vulcan Electric Co., 600 Broad St., Lynn, Mass.

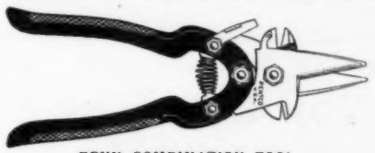


VULCAN SOLDER POT

■

Tool

Penco No. 90 compound action combination cutter snip, wire cutter and splicer will cut any grade metal up to 16 gauge, also flexible pipe and tubing. Has special locking device that will not interfere with cutting operations. Makes a ¼-in. short cut and up to 1¼-in. long cut. Blades can be removed and adjusted. Penn Tool Company, 2415 N. Howard St., Philadelphia.

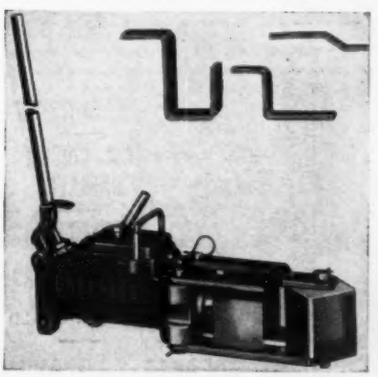


PENN COMBINATION TOOL

■

Bus-Bar Bender

A bus-bar bender has been added to this line of hydraulic benders for rigid conduit, pipe and thinwall steel tubing. It consists of standard power unit of conduit benders, fitted with bus-bar bending attachment. Attachment can be purchased separately for application to benders now in use. It handles bars up to 4-in. wide and ¾-in. thick. U-bends of any size can be made. Greenlee Tool Co., Rockford, Ill.



GREENLEE BUS-BAR BENDER

SEARCHLIGHT SECTION

(Classified Advertising)

Employment : : Equipment
Business : : (Used or Resale)

"OPPORTUNITIES"

UNDISPLAYED RATE

15 CENTS A WORD. MINIMUM CHARGE $3.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

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Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

POSITION WANTED

YOUNG MAN, 35, American, white with four years service work, house wiring experience, I-C-S-student graduate of Westinghouse and Lincoln welding schools, three years of Neon Sign installation and service. Any state. PW-14, Electrical Contracting, 520 N. Michigan Ave., Chicago, Ill.

SELLING OPPORTUNITY WANTED

Sales organization desires electrical specialty of merit for Wisconsin, Minnesota, and metropolitan Chicago. Now selling leading wholesalers this area. References. RA-15, Electrical Contracting, 520 N. Michigan Ave., Chicago, Ill.

USED EQUIPMENT

You Can Find It at ERIE

One of the most Complete Stocks of Transformers and Electric Motors, write us we have what you want.

Special for this month

6—200 KVA Westinghouse Type SK Transformers. Pri. 2200/4600 Volts. Secondary 220/440 Volts with Oil ready to ship.

1—75 KW Generator with direct Connected exciter. 60 Cycle 3 phase 220/440 Volts, 900 RPM. Base Pulley and Panels complete. Write, wire or phone.

ERIE ELECTRIC MOTOR REPAIR CO., Inc.
129 Church St., Buffalo, N. Y.

OIL SWITCHES
AIR CIRCUIT BREAKERS
TRANSFORMERS
COMPENSATORS
BOUGHT—SOLD

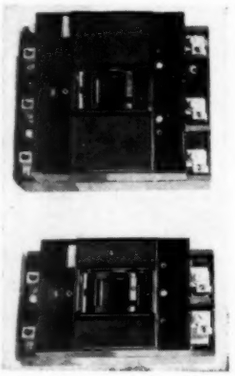
CIRCUIT BREAKER COMPANY
Division of Electric Equipment Co.
347 N. CLINTON AVE. ROCHESTER, N. Y.

EQUIPMENT NEWS

[FROM PAGE 144]

Circuit Breakers

A new line of type AB general utility circuit breakers for enclosure, panelboard or switchboard mounting has been developed. Rated 50, 70, 90 and 100 amperes at 250 and 600 volts a.c., 2 and 3 pole, and 125, 250 volts d.c., they are adaptable to lighting and feeder circuits and motor branch circuit protection. All breakers use 100 ampere frame, permitting physical interchangeability. Adjustable magnetic trip permits close setting of breaker for any tripping current from 3½ to 11 times the normal rated current. Inverse time thermal trip provides protection for light overloads. Special breakers are available with shunt and/or undervoltage trips and if required auxiliary switches can be supplied to open or close separate circuits. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

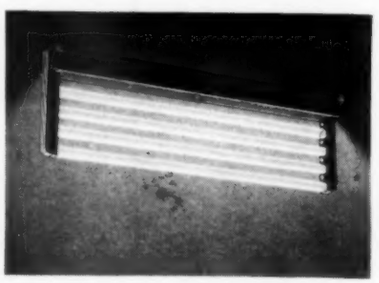


WESTINGHOUSE CIRCUIT BREAKER

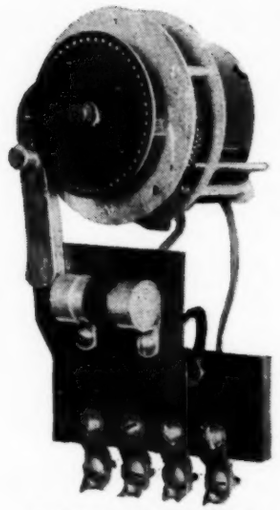
■

Lighting Fixture

Type D fluorescent lighting fixture has been designed for 10- to 12-ft. ceilings in retail stores and department buildings. Available in two, four or six lamps and for 40 and 20 watt lamps. Uses special socket. All equipment is housed in grey wrinkle horizontal part of fixture. Grace Engineering Co., 1616 Patterson St., Dallas, Texas.



GRACE LIGHTING FIXTURE



BACON AUTOMATIC TIMER

Time Switch

This new automatic time switch has been developed for use in signs, apartment halls, poultry houses, window display, motor control, air purifiers, fans and other applications. Has self-starting motor running in oil. Contacts are mercury to mercury type enclosed in metal tubes. Has one moving part. Dial is marked for correct time settings and any practical number of time periods or operations can be had in 24 hours, of any lengths. Emra D. Bacon, 4513 Brooklyn Ave., Cleveland, Ohio.

■

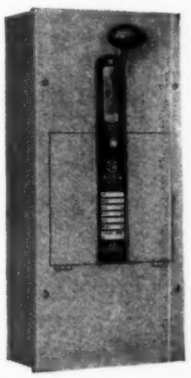
HOLOPHANE LIGHTING UNIT

Lighting Unit

The S-5640 is a luminous indirect lighting unit for use with 500 watt silver bowl lamp. Prismatic action of outer skirt of luminaire bends light out at wide angles over ceiling. It is recommended for use in offices, classrooms, drafting rooms and stores. Unit is of suspension type consisting of crystal glass fluted prismatic bowl with suspension type fitter. Bowl is held to fixture by three rods. Holophane Co., Inc., 342 Madison Ave., New York, N. Y.

Switch

The Shutlbrak switch is a front-operated enclosed safety switch for either surface or flush mounting. It is a heavy duty industrial switch with quick make and break connections held under compression. Line and load connections are enclosed in insulated shuttle, which contains movable contacts. An arc-resisting barrier between line and load contacts at all times, it is claimed. Equipped with fuseholders for ferrule or knife-blade types of fuse terminals. Available with or without interlocking arrangement between operating switch lever and door of fuse compartment. Capacities are 30 to 200 amp. for 250-volt a.c. or d.c. and 575-volt a.c., in 2, 3 or 4 poles. Frank Adam Electric Co., St. Louis, Mo.

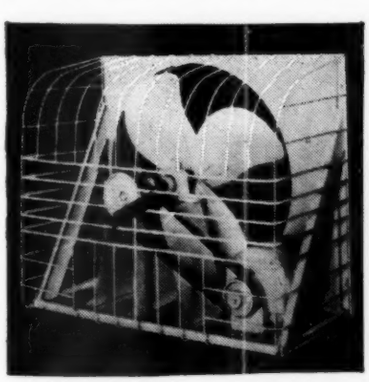


FRANK ADAM SHUTLBRAK SWITCH

■

Fan

Wind-O-Fan, Jr. is designed for use in homes, apartments, stores and offices. Adjustable spacer is furnished so unit will fit in window ranging in width from 26- to 32-inches. Fan delivers 3000 cubic feet of air per minute. A 19-inch blade is belt driven by 1/6 hp., 1750 rpm. motor. Overall dimensions are height 20-9/16-in., length 26-in., depth 12½-in. Furnished complete with all accessories for installation. Chelsea Fan & Blower Co., Inc., 370 West 15th Street., New York, N. Y.



CHELSEA WIND-O-FAN, JR.

KWIKON Set Screw "E.M.T." Fittings are

Truly Economical

Because you pay less for them* —and because you install them faster and easier — Kwikon Set Screw "E.M.T." Fittings effect savings for you right down through the finished job. That is true economy.

***Ask your jobber about the new, low prices!**

Approved by Underwriters' Laboratories, Inc.

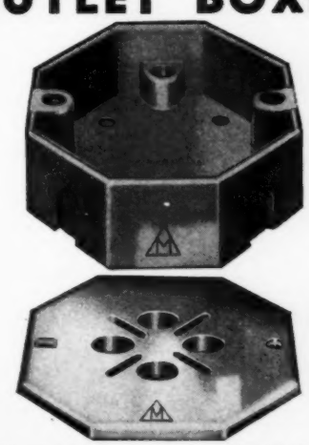
KWIKON CO. 626 W. JACKSON CHICAGO, ILLINOIS

Profit by USING

ILLINOIS

Dependable Porcelain

OUTLET BOXES



★ Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

easy, extra profit

INSTALL

LAFAYETTE SOUND

Lafayette advanced Sound engineering makes it easy for you now to get the extra profits in Sound installation. Modern Lafayette Sound Systems can be installed quickly and easily, which means less installation costs . . . more profit to you. Lafayette offers a complete line of portable and permanent Sound Systems, which means extra business both indoors and out. Send at once for full details.

ALL YOU NEED TO KNOW *about Sound is told in Lafayette's new catalog. If you know P.A. costs and value, here's convincing proof that Lafayette helps you most in getting that profitable, extra Sound business. This book is free. Mail coupon today.*

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NEW YORK • CHICAGO • BOSTON • NEWARK
ATLANTA • JAMAICA • BRONX

LAFAYETTE RADIO CORP.
Dept. 92K—100 Sixth Ave., New York, N. Y.
Please Rush FREE Catalog.

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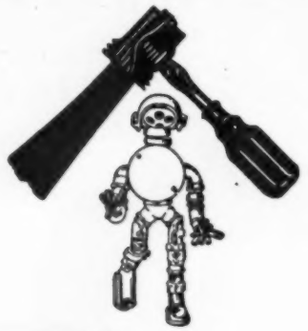
ADDRESS.....
CITY..... STATE.....



The RATTAN Man Says
(Trade Mark Reg.)
Do it with
The MARR
A Perfect Joint Connector
(CAP MADE OF BAKELITE)
For a perfect, permanent joint, simply insert wires, tighten screw and turn on bakelite cap.
Send for free samples.
See Your Electrical Dealer
Approved by Underwriters
THE RATTAN MANUFACTURING COMPANY
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NEW HAVEN, CONN., U. S. A.
GENERAL SALES AGENTS HATHEWAY AND CO.
220 CHURCH STREET, NEW YORK, N. Y., U. S. A.

SAVE YOURSELF TROUBLE
In replacing broken sockets in Fluorescent Fixtures use the ALDEN RoToLoK Socket. Users can't go wrong in using them. Impossible to get prongs behind contacts or set up wedging strains that generally break other makes of sockets.
When ordering new fixtures specify
ALDEN
RoToLoK
FLUORESCENT SOCKETS
Patents Pending
Molded end of socket guides clamp prongs into the one simple opening—then the natural obvious twist locks the lamp in place. A reverse twist and the ejector latch gently raises lamp out of socket and locks rotor ready for next insertion—a feature especially desirable in showcase and out-of-sight fixtures.
Send for complete story.
ALDEN PRODUCTS CO.
718 Center St. Brockton, Mass.

TEST-O-LITE
Tests Everything Electrical From 100 to 550 Volts
APPLIANCES
MOTORS
FUSES
Indispensable to electricians. Equipped with Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, electric appliances; indicates hot or grounded wires; tells A.C. from D.C.
Only Test-O-Lite, original Neon tester, has exclusive patented safety features. Far superior to clumsy test bulb. Fountain pen size with pocket clip. Useful in homes also. List $1.50 at leading jobbers.
L. S. BRACH
MANUFACTURING CORPORATION
57 Dickerson St., Newark, N. J.

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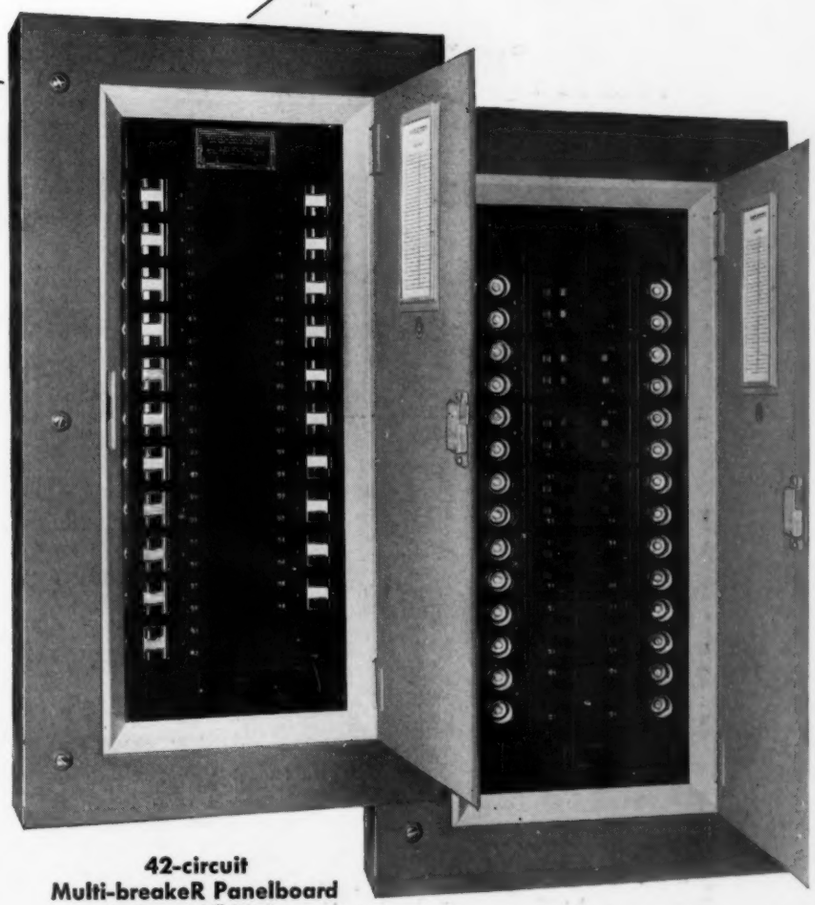
* See 1939–1940 Buyers' Reference number of Electrical Contracting for additional information on these companies and their products.

MORE LIGHTING CIRCUITS NEEDED?
PRESENT CIRCUITS OVERLOADED?

Here is the Simple Economical Answer



42-circuit
Multi-breakeR Panelboard
in box 35" high

28-circuit fusible panelboard
in box 35" high

Use new thin wall wire and SQUARE D MULTI-BREAKER PANELBOARDS

A lot of valuable time is being lost because of overloaded electrical systems. More circuits are needed to take care of the ever-increasing lighting and appliance load.

In the past it has often been impossible to provide for this increasing load without a costly revamping of the entire system. Now the new small diameter wire permits use of more wires in existing conduit. The use of Multi-breakeR lighting panel interiors in present boxes will accommodate the additional circuits made possible by the new wire.

Notice that the Multi-breakeR panelboard illustrated in the same size box as the fusible panelboard will provide fourteen additional circuits. Even in smaller size panels the increase in circuits may be up to 50%.

It is unnecessary to remove lighting panel boxes imbedded in walls. Multi-breakeR panelboard interiors can be installed in present boxes. For such installations, fronts especially designed to fit existing panel boxes are furnished.

Multi-breakeR panelboards provide branch circuit capacity up to 50 amperes.

Square D Multi-breakeRs protect the wire at its rated capacity and will handle inrush currents without needless tripping. When tripped by overloads or short circuits, the current is conveniently restored by moving the handle to the reset position and then "on." There are no parts to replace. Multi-breakeR panels are safe—no live parts are exposed even when restoring current. Due to lower watt loss, Multi-breakeR panels operate at about ½ of the temperature rise of fusible panels. The temperatures necessary to melt fusible links are not required in the operation of the Multi-breakeR unit since the overload element (the bi-metal) becomes hot enough to deflect and release the mechanism only when an overload actually exists.

With thin wall wire and Multi-breakeR panelboards, contractors have the simple, economical answer to an overload problem which exists in scores of commercial and industrial buildings.

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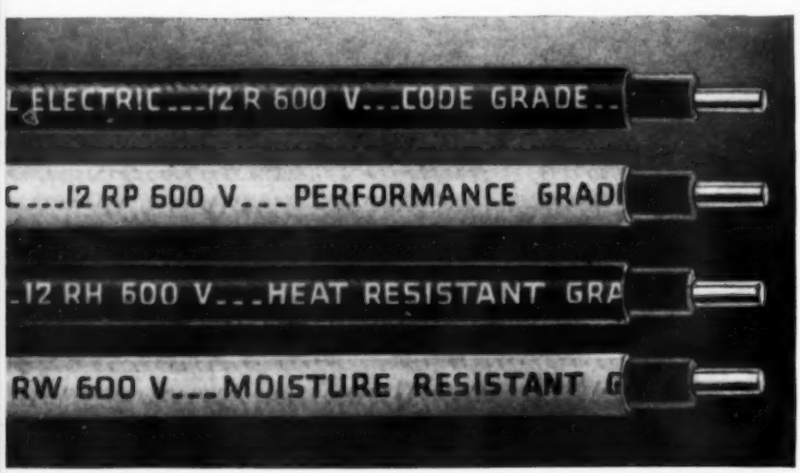
This new G-E synthetic-insulated wire can be obtained wherever you buy other G-E wiring materials. Whole wiring systems can be rewired inexpensively. Flamenol is available in sizes 14 to 4/0. Its insulation is tough, flame-retarding and resistant to moisture, acids, oil, etc. It is approved by the Underwriters' Laboratories. Other materials needed for rewiring will all be found in the G-E line.

For further information about G-E wiring materials to serve modern lighting either in old or new buildings see the nearest G-E Merchandise Distributor. Or mail the coupon below.

*Reg. U. S. Pat. Off.



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